



DEPARTMENT OF EDUCATION
DEPARTEMENT VAN ONDERWYS
LEFAPHA LA THUTO
ISEBE LEZEMFUNDO

**PROVINCIAL PREPARATORY EXAMINATION/
PROVINSIALE VOORBEREIDENDE EKSAMEN**

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GRADE/GRAAD 12

MATHEMATICS/WISKUNDE

PAPER/VRAESTEL 2

SEPTEMBER 2025

MARKING GUIDELINES/NASIENRIGLYNE

MARKS/PUNTE: 150

**These marking guidelines consist of 18 pages./
Hierdie nasienriglyne bestaan uit 18 bladsye.**

NOTE:

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- If a candidate has crossed out an attempt of a question and not redone the question, mark the crossed-out version.
- Consistent accuracy applies in ALL aspects of the marking memorandum. Stop marking at the second calculation error.
- Assuming answers/values to solve a problem is NOT acceptable.

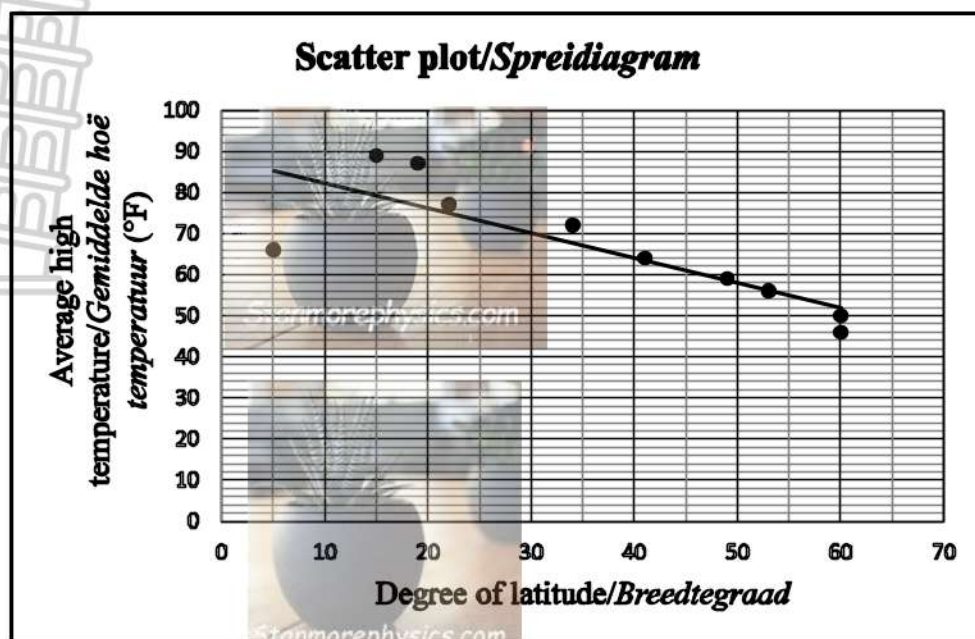
NOTA:

- As 'n kandidaat 'n vraag TWEE KEER beantwoord, sien slegs die EERSTE poging na.
- As 'n kandidaat 'n antwoord van 'n vraag doodtrek en nie oordoen nie, sien die doodgetrekte poging na.
- Volgehoue akkuraatheid word in ALLE aspekte van die nasienriglyne toegepas. Hou op nasien ná die tweede berekeningsfout.
- Om antwoorde/waardes aan te neem om 'n probleem op te los, word NIE toegelaat NIE.

GEOMETRY/MEETKUNDE	
S	A mark for a correct statement (A statement is independent of a reason)
	'n Punt vir 'n korrekte bewering ('n Punt vir 'n bewering is onafhanklik van die rede)
R	A mark for the correct reason (A reason mark may only be awarded if the statement is correct)
	'n Punt vir 'n korrekte rede ('n Punt word slegs vir die rede toegeken as die bewering korrek is)
S/R	Award a mark if statement AND reason are both correct
	Ken 'n punt toe as die bewering EN rede beide korrek is



QUESTION/VRAAG 1

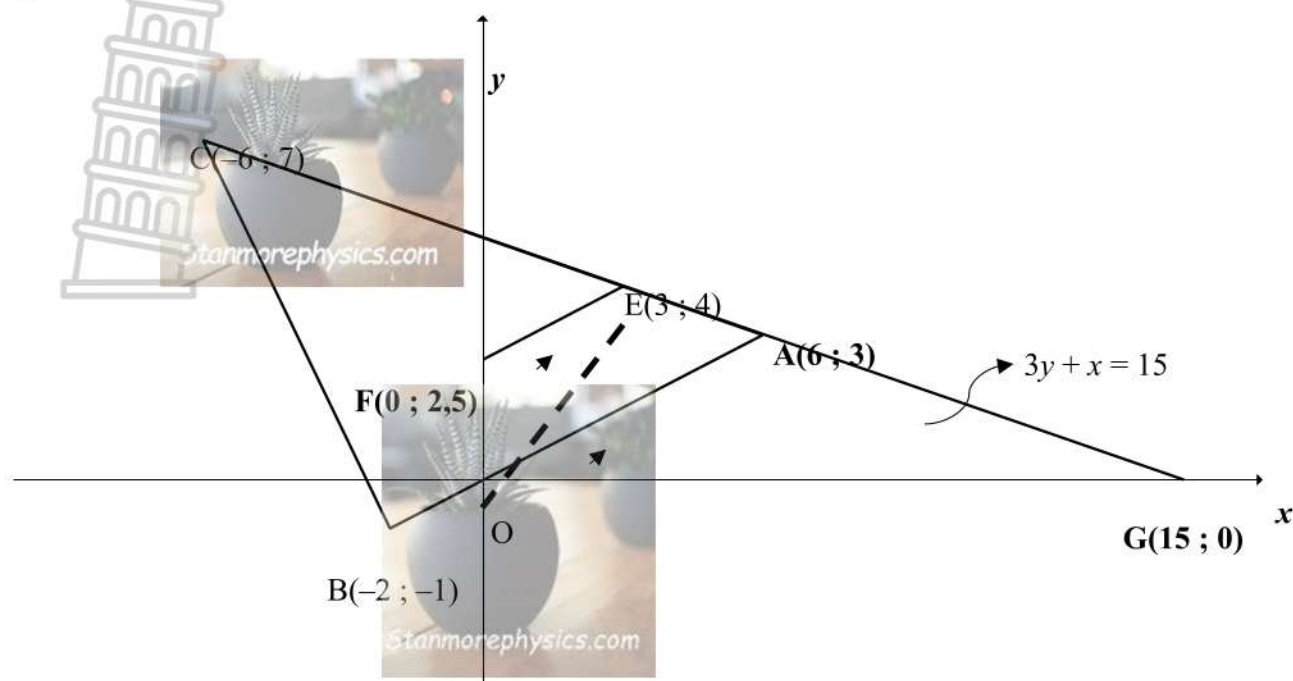


1.1	Strong negative correlation/ <i>Sterk negatiewe korrelasie</i> Data points are close to the regression line/ <i>Data punte lê naby regressielyn.</i>	✓ strong/ <i>sterk</i> ✓ reason/ <i>rede</i>	(2)																						
	<table><tr><td>Latitude in degrees/ <i>Beedtegraad</i></td><td>5</td><td>19</td><td>34</td><td>53</td><td>22</td><td>41</td><td>60</td><td>15</td><td>60</td><td>49</td></tr><tr><td>Average high temperature/<i>Gemiddelde hoë temperatuur (in °F)</i></td><td>66</td><td>87</td><td>72</td><td>56</td><td>77</td><td>64</td><td>46</td><td>89</td><td>50</td><td>59</td></tr></table>	Latitude in degrees/ <i>Beedtegraad</i>	5	19	34	53	22	41	60	15	60	49	Average high temperature/ <i>Gemiddelde hoë temperatuur (in °F)</i>	66	87	72	56	77	64	46	89	50	59		
Latitude in degrees/ <i>Beedtegraad</i>	5	19	34	53	22	41	60	15	60	49															
Average high temperature/ <i>Gemiddelde hoë temperatuur (in °F)</i>	66	87	72	56	77	64	46	89	50	59															
1.2	$a = 88,33$ $b = -0,61$ $\hat{y} = 88,33 - 0,61x$ Answer only: Full Marks/ <i>Slegs antwoord: Volpunte</i>	✓ a ✓ b ✓ eq/vgl	(3)																						
1.3	$y = 88,33 - 0,61(28)$ $= 71,25^{\circ}\text{F}$ OR/OF $y = 71,33^{\circ}\text{F}$ (calc/sakr) OR/OF From Diagram: 71-72	✓ subst ✓ answ/antw ✓✓ answ/antw	(2) (2)																						
1.4	$\sigma_y = 13,9^{\circ}\text{F}$	✓ answ/antw	(1)																						
1.5	$\bar{y} = 66,6$ $66,6 + 13,9 = 80,5$ $\therefore$ 2 Cities / <i>Stede</i> CA: From 1.4 if learner used $\sigma_x = 18,77$ $35,8 + 18,77 = 54,58$ 2 cities (3/3)	✓ mean ✓ mean + σ_y ✓ answ/antw	(3)																						
			[11]																						

QUESTION/VRAAG 2

2.1	$k = 44$ $f = 6$	✓ k ✓ f (2)
2.2	OGIVE / OGIEF	✓ (60 ; 0) ✓ (90 ; 50) ✓ S-curve/- kurwe (3)
2.3	$M = 77 \text{ kg}$ (accept: 76 – 78 kg) CA from OGIVE/ van OGIEF	✓ $CF = 25$ ✓ answ/antw (2)
2.4	$(83 ; \pm 40)$ (accept: 39 – 41) $\therefore \frac{10}{50} \times 100 = 20\%$	✓ CF ✓ % (2)
		[9]

QUESTION/VRAAG 3

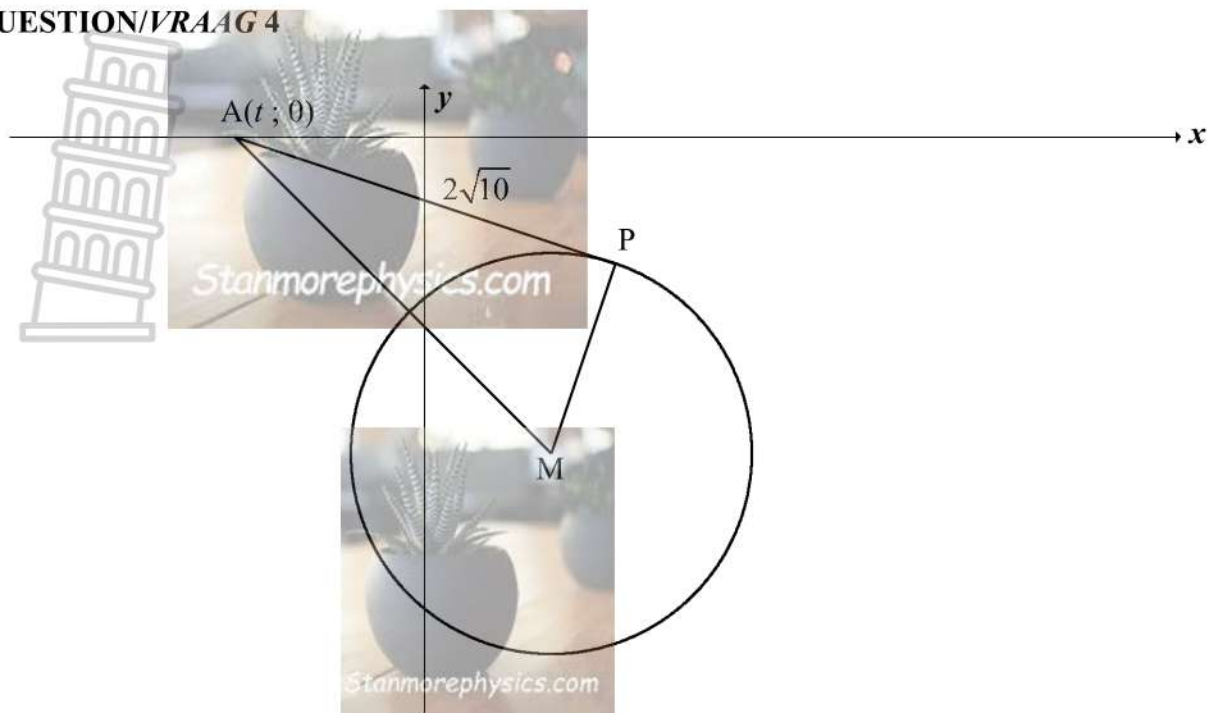


3.1	$m_{AB} = \frac{-1-0}{-2-0} = \frac{1}{2}$	✓ subst B and O ✓ answ/antw (2)
3.2	$m_{CB} = \frac{7+1}{-6+2} = -2$ $m_{AB} \times m_{CB} = \frac{1}{2} \times -2 = -1$ $\therefore CB \perp BA$	✓ subst B and C ✓ m_{CB} ✓ $m_1 \times m_2 = -1$ (3)
3.3	$y = mx + c$ OR / OF $y - y_1 = m(x - x_1)$ $4 = \frac{1}{2}(3) + c$ $y - 4 = \frac{1}{2}(x - 3)$ $c = \frac{5}{2}$ $y = \frac{1}{2}x + \frac{5}{2}$ $y = \frac{1}{2}x + \frac{5}{2}$	✓ $m_{EF} = m_{AB}$ ✓ subst E into equation ✓ eq/vgl (3)
3.4.1	$\tan \hat{AOG} = \frac{1}{2}$ $\hat{AOG} = 26,57^\circ$ $\hat{OFE} = 26,57^\circ + 90^\circ$ (Corr $\angle$'s; $FE \parallel BA$) $= 116,57^\circ$	✓ $\tan \hat{AOG} = \frac{1}{2}$ ✓ size of $\hat{AOG}$ ✓ $\hat{OFE}$ (3)

3.4.2	F(0 ; 2,5) G(15 ; 0) <u>Draw EO</u> area OFEG = area $\triangle OFE$ + area $\triangle EOG$ $= \frac{1}{2} \left(\frac{5}{2} \right) (3) + \frac{1}{2} (15)(4)$ $= 3\frac{3}{4} + 30$ $= 33\frac{3}{4} \text{ units}^2$	✓ coordinates of F ✓ coordinates of G ✓ method ✓ area of $\triangle OFE$ ✓ area of $\triangle EOG$ ✓ area of OFEG (6)
3.5.1	Use midpoint of AC: D(2 ; 11)	✓ x ✓ y (2)
3.5.2 (a)	AC = diameter (converse $\angle$ in semi circle) Centre $\left(\frac{-6+6}{2} ; \frac{7+3}{2} \right) = (0 ; 5)$	✓ x ✓ y (2)
3.5.2 (b)	$r = \sqrt{(0-6)^2 + (5-3)^2}$ $= \sqrt{40}$ $x^2 + (y-5)^2 = 40$	✓ subst into distance formula ✓ LHS ✓ RHS (3)
		[24]



QUESTION/VRAAG 4



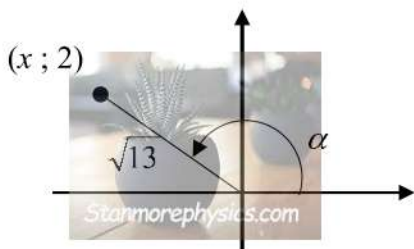
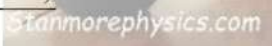
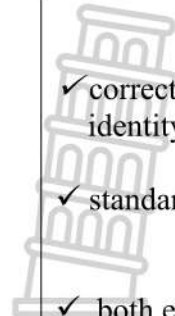
4.1	Radius $\perp$ Tangent	✓ reason (1)
4.2.1	$x^2 - 4x + 4 + y^2 + 10y + 25 = -19 + 4 + 25$ $(x - 2)^2 + (y + 5)^2 = 10$ $\therefore M(2; -5)$ OR/OF $M\left(-\frac{1}{2}(-4); -\frac{1}{2}(10)\right)$ $\therefore M(2; -5)$ Need to show some calculation	✓ LHS & RHS ✓ x ✓y (3) ✓ using formula ✓ x ✓y (3)
4.2.2	$r = \sqrt{2^2 + (-5)^2 - 19}$ $= \sqrt{10}$ Answer only: Full Marks/ Slegs antwoord: Volpunte	✓ answer/antwoord (1)
4.3	$AM^2 = AP^2 + MP^2 \text{ (Pyth th)}$ $(t - 2)^2 + (0 + 5)^2 = (2\sqrt{10})^2 + (\sqrt{10})^2$ $t^2 - 4t + 4 + 25 = 40 + 10$ $t^2 - 4t - 21 = 0$ $(t - 7)(t + 3) = 0$ $\therefore t = -3 \text{ (given)}$	✓ subst into distance formula ✓ correct use of Pyth th ✓ standard form ✓ factors (4)

4.4.1	$y = -5 - 3$ $= -8$ $\therefore N(5; -8)$	✓ substitution ✓ y-value of N (2)
4.4.2	$MN = \sqrt{(-5 - (-8))^2 + (2 - 5)^2}$ $= 3\sqrt{2} = 4,24 \text{ units}$ Radius of circle N = $\sqrt{40} = 2\sqrt{10} = 6,32 \text{ units}$ Sum of two radii = $\sqrt{10} + \sqrt{40} = 3\sqrt{10} = 9,49 \text{ units}$ $\therefore MN < \text{sum of 2 radii}$ $\therefore 2 \text{ circles intersect}$	✓ subst into distance formula ✓ MN ✓ radius of N ✓ sum of radii ✓ answer (5)
		[16]

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QUESTION/VRAAG 5

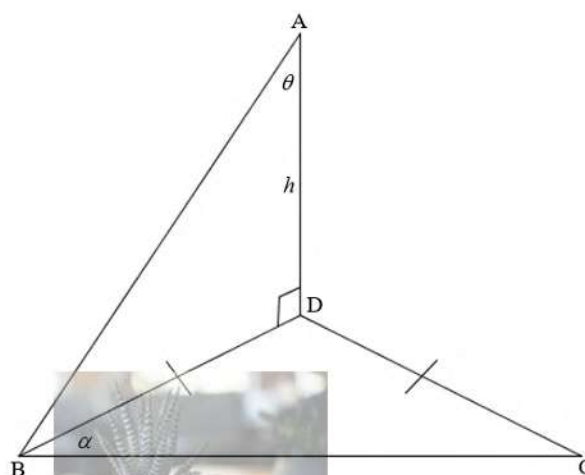
5.1.1	$\sin \alpha = \frac{2}{\sqrt{13}}$ $x^2 + y^2 = r^2$ $x^2 + 4 = 13$ $x^2 = 9$ $x = -3$ $\tan \alpha = -\frac{2}{3}$ 	✓ 2nd quadrant ✓ subst into Pyth ✓ value of x ✓ answer/antw (4)
5.1.2	$\sin(90^\circ - \alpha) = \cos \alpha$ $= \frac{-3}{\sqrt{13}}$ 	✓ co-function ✓ answer/antwoord (2)
5.2	$\frac{\sin(180^\circ + \theta) \cdot \cos(90^\circ + \theta)}{\tan \theta \cdot \cos(-\theta)}$ $\frac{-\sin \theta \cdot -\sin \theta}{\frac{\sin \theta}{\cos \theta} \cdot \cos \theta}$ $= \sin \theta$ OR $= \frac{-\sin \theta \cdot -\sin \theta}{\tan \theta \cdot \cos \theta}$ $= \frac{\tan \theta \sin \theta}{\tan \theta}$ $= \sin \theta$ 	✓ $-\sin \theta$ ✓ $-\sin \theta$ ✓ $\cos \theta$ ✓ $\frac{\sin \theta}{\cos \theta}$ ✓ $\sin \theta$ (5) ✓ $-\sin \theta$ ✓ $-\sin \theta$ ✓ $\cos \theta$ ✓ $\tan \theta$ ✓ $\sin \theta$ (5)
5.3	$\sin x = 1 - \cos 2x$ $\sin x = 1 - (1 - 2\sin^2 x)$ $\sin x = 1 - 1 + 2\sin^2 x$ $\sin x - 2\sin^2 x = 0$ $\sin x(1 - 2\sin x) = 0$ $\sin x = 0 \text{ or / of } \sin x = \frac{1}{2}$ $\sin x = 0$: $x = 0^\circ + k \cdot 360^\circ \text{ or } 180^\circ + k \cdot 360^\circ; k \in \mathbb{Z}$ $\sin x = \frac{1}{2}$: $x = 30^\circ + k \cdot 360^\circ \text{ or / of } x = 150^\circ + k \cdot 360^\circ; k \in \mathbb{Z}$	 ✓ correct double identity ✓ standard form ✓ both equations ✓ 0° & 180° ✓ 30° & 150° ✓ $+ k \cdot 360^\circ; k \in \mathbb{Z}$ (6)

5.4.1	$\begin{aligned} \text{LHS} &= \sin A \cos B + \cos A \sin B + \sin A \cos B - \cos A \sin B \\ &= 2 \sin A \cos B \\ &= \text{RHS} \end{aligned}$	✓ expansion of $\sin(A+B)$ ✓ expansion of $\sin(A-B)$ (2)
5.4.2	$\begin{aligned} \text{LHS} &= \frac{\sin(5x+2x) + \sin(5x-2x)}{\cos(5x+2x) + \cos(5x-2x)} \\ &= \frac{2 \sin 5x \cos 2x}{\cos 5x \cos 2x - \sin 5x \sin 2x + \cos 5x \cos 2x + \sin 5x \sin 2x} \\ &= \frac{2 \sin 5x \cos 2x}{2 \cos 5x \cos 2x} \\ &= \frac{\sin 5x}{\cos 5x} \\ &= \tan 5x = \text{RHS} \end{aligned}$ OR/OF $\begin{aligned} \text{LHS} &= \frac{\sin(5x+2x) + \sin(5x-2x)}{\cos(5x+2x) + \cos(5x-2x)} \\ &= \frac{2 \sin 5x \cos 2x}{\sin[90^\circ - (5x+2x)] + \sin[90^\circ - (5x-2x)]} \\ &= \frac{2 \sin 5x \cos 2x}{\sin[(90^\circ - 5x) - 2x] + \sin[(90^\circ - 5x) + 2x]} \\ &= \frac{2 \sin 5x \cos 2x}{2 \sin(90^\circ - 5x) \cos(2x)} \\ &= \frac{2 \sin 5x \cos 2x}{2 \cos 5x \cos 2x} \\ &= \tan 5x \end{aligned}$	✓ $5x+2x$ & $5x-2x$ ✓ simplify numerator ✓ expand denominator ✓ simplify denominator ✓ simplify fraction (5) ✓ $5x+2x$ & $5x-2x$ ✓ simplify numerator ✓ expand denominator ✓ simplify denominator ✓ simplify fraction (5)
		[24]

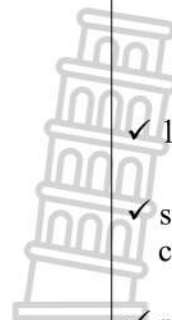
QUESTION/VRAAG 6

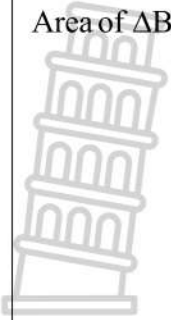
6.1	$a = 2$ $b = 30^\circ$	✓ a ✓ b (2)
6.2		✓ y-intercept ✓ max tps ✓ min tps (3)
6.3	180°	✓ answer/antw (1)
6.4	$2g(x) = 2 \sin 2x + 2$ $\therefore 0 \leq y \leq 4$ OR $y \in [0;4]$	✓ $2g(x)$ ✓ critical values ✓ inequalities (3)
6.5.1	$x \in [-180^\circ; -90^\circ)$ OR $-180^\circ \leq x < -90^\circ$	✓ critical values ✓ inequalities (2)
6.5.2	where $\cos(x + b) = 0$ $x = -120^\circ$ or 60°	✓ -120° ✓ 60° (2)
6.6	$p(x) = \sin[2(x + 45^\circ)] + 1$ $\quad = \sin(2x + 90^\circ) + 1$ $p(x) = \cos 2x + 1$	Answer only: Full Marks/ Slegs antwoord: Volpunte ✓ correct subst of $x + 45^\circ$ ✓ answer/antwoord (2)
		[15]

QUESTION/VRAAG 7



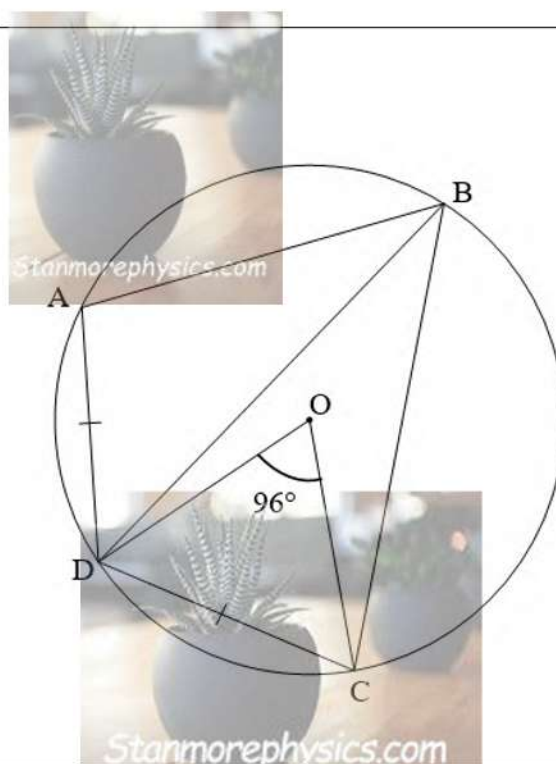
7.1	$\tan \theta = \frac{BD}{h}$ $BD = h \tan \theta$	✓ tan ratio ✓ answer/ antwoord (2)
7.2	$\hat{DCB} = \alpha \quad (\angle s \text{ opp} = \text{sides}) / (\angle e \text{ to} = \text{sye})$ $\hat{BDC} = 180^\circ - 2\alpha \quad (\angle^{s/e} \text{ of/van } \Delta)$ $\frac{BC}{\sin(180^\circ - 2\alpha)} = \frac{BD}{\sin \alpha}$ $\frac{BC}{\sin 2\alpha} = \frac{h \tan \theta}{\sin \alpha}$ $BC = \frac{h \tan \theta \sin 2\alpha}{\sin \alpha}$ $= \frac{h \tan \theta \cdot 2 \sin \alpha \cos \alpha}{\sin \alpha}$ $= 2h \tan \theta \cos \alpha$ OR/OF $BC^2 = (h \tan \theta)^2 + (h \tan \theta)^2 - 2(h \tan \theta) \cos(180^\circ - 2\alpha)$ $= h^2 \tan^2 \theta + h^2 \tan^2 \theta - 2h^2 \tan^2 \theta (-\cos 2\alpha)$ $= 2h^2 \tan^2 \theta (1 + \cos 2\alpha)$ $= 2h^2 \tan^2 \theta (2 \cos^2 \alpha)$ $BC = \sqrt{4h^2 \tan^2 \theta \cos^2 \alpha}$ $BC = 2h \tan \theta \cos \alpha$	✓ $180^\circ - 2\alpha$ ✓ subst into sin rule ✓ reduction ✓ sin double angle identity (4) ✓ $180^\circ - 2\alpha$ ✓ subst into cos rule ✓ reduction ✓ cos double angle identity (4)



7.3	 $\begin{aligned}\text{Area of } \triangle BDC &= \frac{1}{2} BD \cdot DC \cdot \sin \hat{BDC} \\ &= \frac{1}{2} (h \tan \theta) (h \tan \theta) \sin(180^\circ - 2\alpha) \\ &= \frac{1}{2} (5 \tan 40^\circ) (5 \tan 40^\circ) \sin 130^\circ \\ &= 6,74 \text{ units}^2\end{aligned}$	✓ subst into area rule ✓ subst values ✓ answer/antwoord (3)
		[9]

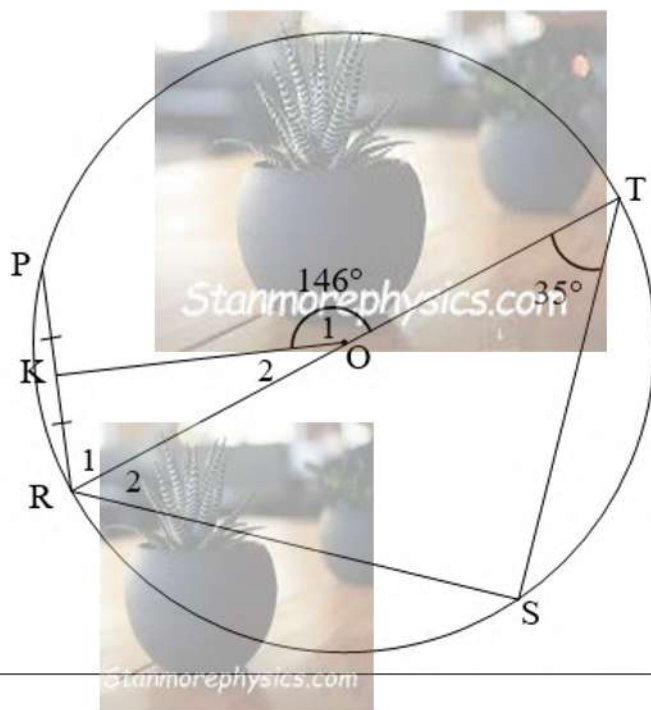
QUESTION/VRAAG 8

8.1



8.1.1	$\hat{DBC} = 48^\circ$ ($\angle$ at centre = $2 \angle$ at circle / midpts $\angle = 2 \text{ omtreks } \angle$)	✓ S ✓ R (2)
8.1.2	$\hat{ABD} = 48^\circ$ (= chords; = $\angle$ s / = koorde; = $\angle$ e)	✓ S ✓ R (2)
8.1.3	$\hat{ODC} = 42^\circ$ ($\angle^s$ opp = sides / $\angle^e$ to = sye) $\hat{ADC} = 180^\circ - 96^\circ$ (opp $\angle^s$ cyc quad / to $\angle^e$ koordevh) $= 84^\circ$ $\hat{ADO} = 84^\circ - 42^\circ$ $= 42^\circ$	✓ S ✓ R ✓ S ✓ R ✓ answer/antwoord (5)

8.2

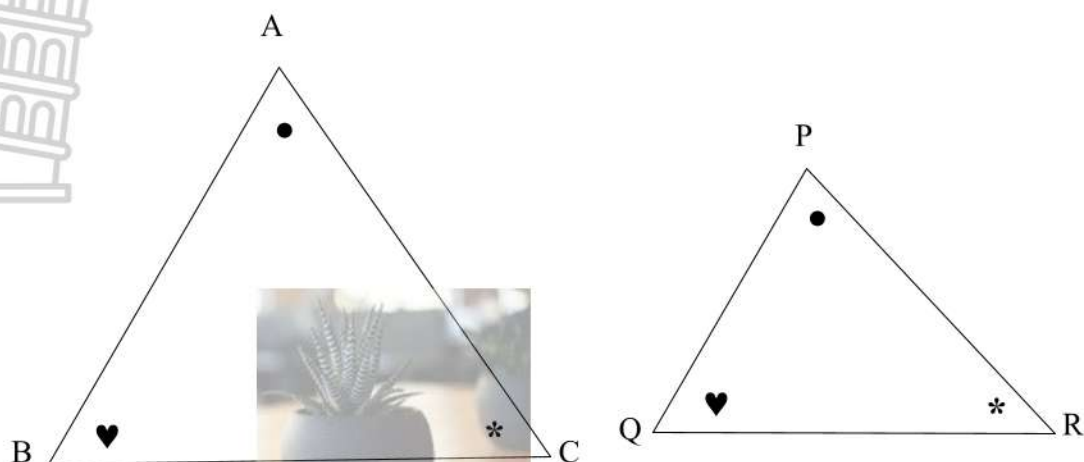


	$\hat{S} = 90^\circ$ ($\varnothing$ in half circle) $\hat{R}_2 = 55^\circ$ ($\angle^s$ of Δ) $O_2 = 34^\circ$ ($\angle^s$ on a straight line) $R\hat{K}O = 90^\circ$ (line from centre to midpt of chord) $\hat{R}_1 = 56^\circ$ (ext $\angle$ of Δ) $P\hat{R}S = 56^\circ + 55^\circ = 111^\circ$ OR/OF $\hat{S} = 90^\circ$ ($\varnothing$ in half circle) $\hat{R}_2 = 55^\circ$ ($\angle^s$ of Δ) $R\hat{K}O = 90^\circ$ (line from centre to midpt of chord) $\hat{R}_1 = 56^\circ$ (ext $\angle$ of Δ) $P\hat{R}S = 56^\circ + 55^\circ = 111^\circ$	$\checkmark$ S $\checkmark$ R $\checkmark$ S $\checkmark$ S $\checkmark$ R $\checkmark$ S/R $\checkmark$ answer/ <i>antwoord</i> (7) $\checkmark$ S $\checkmark$ R $\checkmark$ S $\checkmark$ S $\checkmark$ R $\checkmark$ S/R $\checkmark$ answer/ <i>antwoord</i> (7) [16]
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QUESTION/VRAAG 9

9.1



Constr:

Let G and H lie on AB and AC respectively such that AG = PQ and AH = PR. Draw GH.

Proof:

In $\triangle AGH$ and $\triangle PQR$:

AG = PQ [Constr]

AH = PR [Constr]

$\hat{A} = \hat{P}$ [Given]

$\therefore \triangle AGH \equiv \triangle PQR$ (SAS)

$\therefore \hat{AGH} = \hat{Q}$

GH $\parallel$ BC [corresp $\angle$'s are equal]

$\frac{AB}{AG} = \frac{AC}{AH}$ [line $\parallel$ one side of $\triangle$ OR prop theorem; MN $\parallel$ BC]

$\therefore \frac{AB}{PQ} = \frac{AC}{PR}$ [AM = DE and AN = DF]

✓ constr

✓ S ✓ R

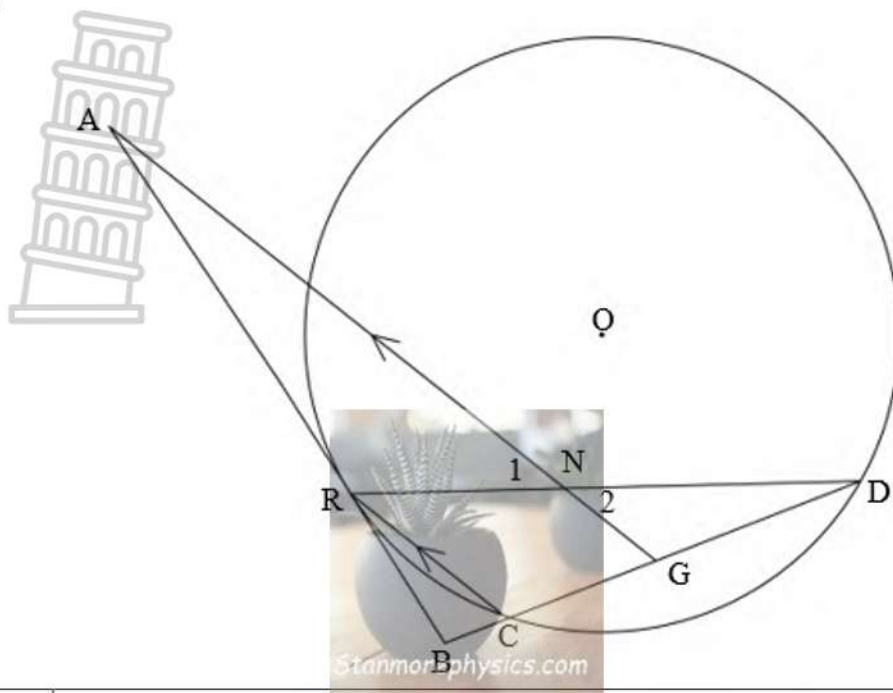
✓ S/R

✓ S ✓ R

(6)



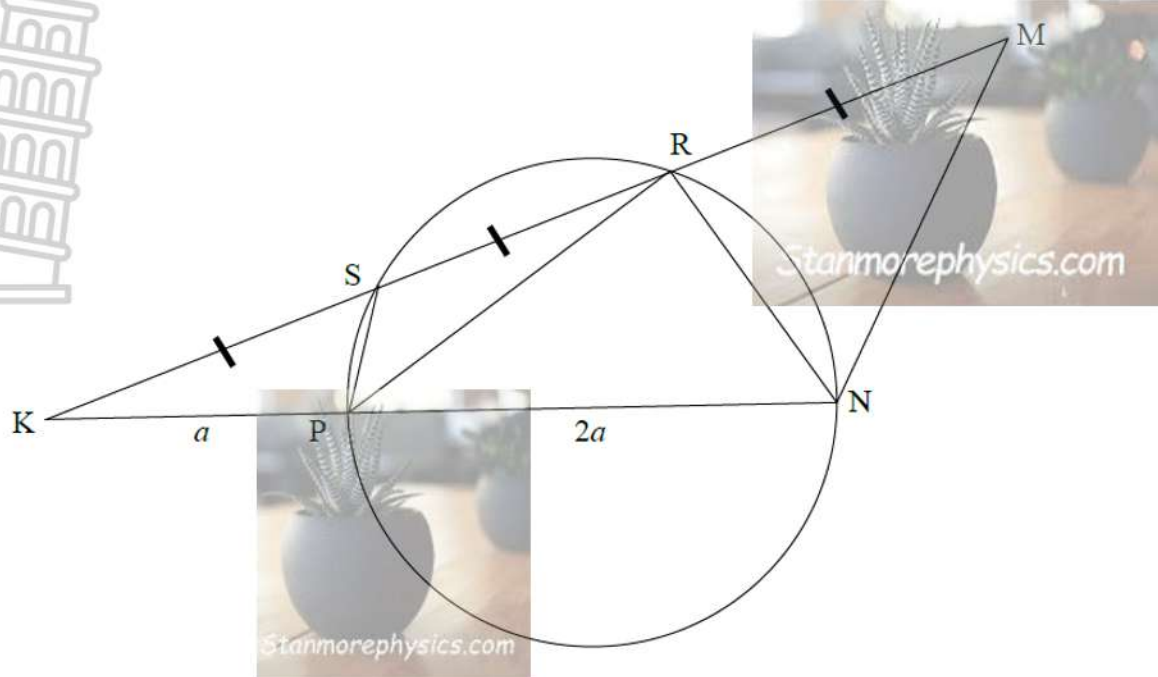
9.2



9.2.1	In $\triangle DNG \parallel \triangle ANR$: $\hat{N}_1 = \hat{N}_2$ (vert opp $\angle$s/<i>regootst</i> $\angle$e) $\hat{A}RN = \hat{R}CD$ (tan chord th/<i>rkl koord st</i>) $\hat{R}CD = \hat{N}GD$ (corresp $\angle$s/<i>ooreenk</i> $\angle$e ; RC $\parallel$ AG) $\therefore \triangle DNG \parallel \triangle ANR$ (AAA) OR/OF In $\triangle DNG \parallel \triangle ANR$: $\hat{N}_1 = \hat{N}_2$ (vert opp $\angle$s/<i>regootst</i> $\angle$e) $\hat{A}RN = \hat{R}CD$ (tan chord th/<i>rkl koord st</i>) $\hat{R}CD = \hat{N}GD$ (corresp $\angle$s/<i>ooreenk</i> $\angle$e ; RC $\parallel$ AG) $\hat{A} = \hat{D}$ ($\angle$s of $\triangle$/$\angle$e v $\triangle$) $\therefore \triangle DNG \parallel \triangle ANR$	✓ S/R ✓ S ✓ R ✓ S/R ✓ R (5)
9.2.2	$\hat{B}RC = \hat{D}$ (tan chord th/<i>rkl koord st</i>) $\hat{A} = \hat{D}$ ($\parallel \Delta$s/<i>e</i>) $\therefore \hat{B}RC = \hat{A}$	✓ S/R ✓ S (2)

[13]

QUESTION/VRAAG 10



- ✓ $2 \angle s =$
OR $3a$
- ✓ correct
- ✓ proportion

10.2	$\frac{PN}{NM} = \frac{NR}{MR} \quad (\text{Similar } \Delta\text{'s})$ $\frac{2a}{NM} = \frac{NR}{6}$ $\text{but } NR = \frac{4NM}{a}$ $\frac{2a}{NM} = \frac{4NM}{6a}$ $4NM^2 = 12a^2$ $NM = \sqrt{3}a$	✓ ratio ito NM and NR ✓ subst NR ✓ answer/antwoord (3)
		[16]
		TOTAL: 150

