



LIMPOPO

PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
EDUCATION

NATIONAL SENIOR CERTIFICATE/
NASIONALE SENIOR SERTIFIKAAT

GRADE 12/GRAAD 12

MATHEMATICS P2/WISKUNDE V2
SEPTEMBER 2026/SEPTEMBER 2026
MARKING GUIDELINES/NASIENRIGLYNE

MARKS/PUNTE: 150

This marking guidelines consists 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 Guidelines. Stop marking at the second calculation error.

Assuming answers/values to solve a problem is NOT acceptable.

LET WEL:

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.

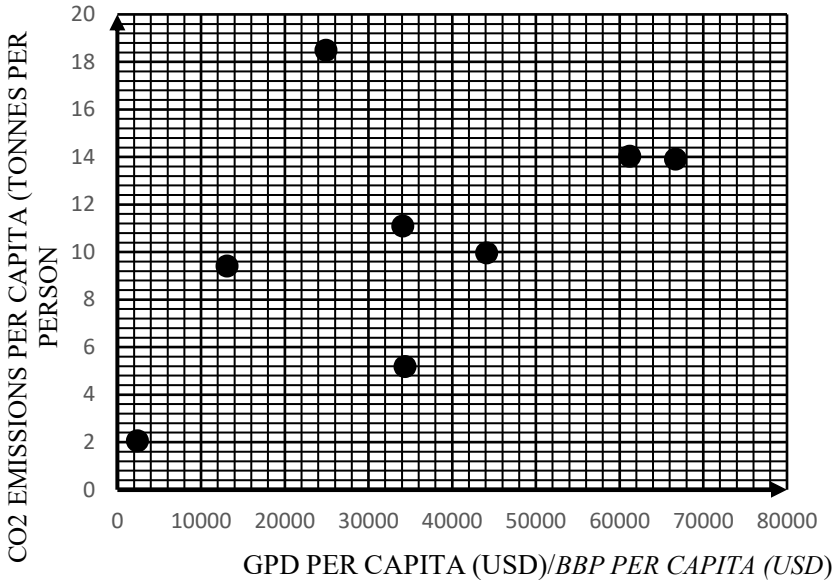
Volgehoue akkuraatheid word in ALLE aspekte van die Nasienriglyne toegepas. Hou op nasien by die tweede berekeningsfout.

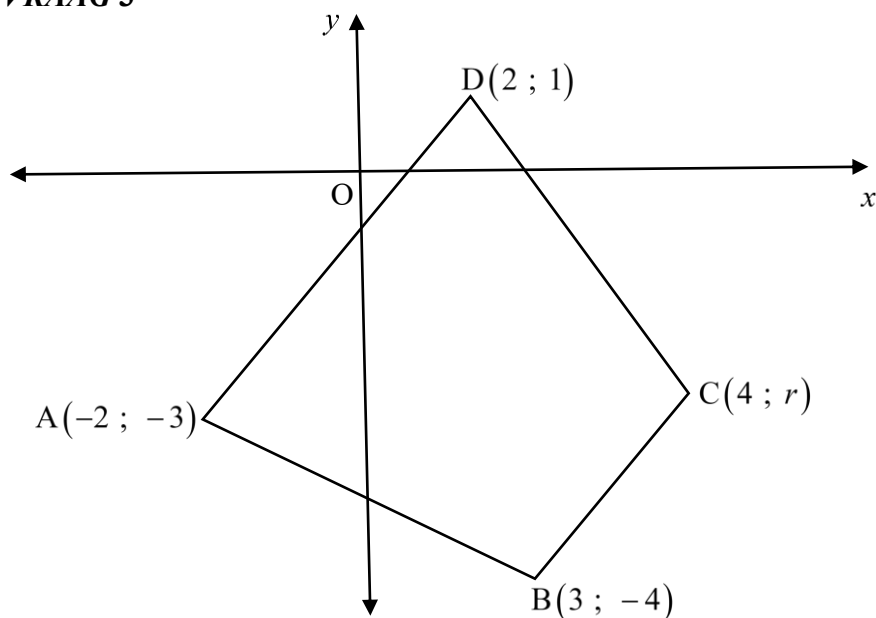
Aanvaar van antwoorde/waardes om 'n probleem op te los, word NIE toegelaat nie.

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

QUESTION/VRAAG 1

1.1	<table border="1"> <thead> <tr> <th>Screen time (hours)</th><th>Frequency</th><th>Cumulative Frequency</th></tr> </thead> <tbody> <tr> <td>$0 < x \leq 1$</td><td>0</td><td>0</td></tr> <tr> <td>$1 < x \leq 2$</td><td>2</td><td>2</td></tr> <tr> <td>$2 < x \leq 3$</td><td>5</td><td>7</td></tr> <tr> <td>$3 < x \leq 4$</td><td>9</td><td>16</td></tr> <tr> <td>$4 < x \leq 5$</td><td>12</td><td>28</td></tr> <tr> <td>$5 < x \leq 6$</td><td>7</td><td>35</td></tr> <tr> <td>$6 < x \leq 7$</td><td>5</td><td>40</td></tr> <tr> <td>$7 < x \leq 8$</td><td>0</td><td>40</td></tr> </tbody> </table>	Screen time (hours)	Frequency	Cumulative Frequency	$0 < x \leq 1$	0	0	$1 < x \leq 2$	2	2	$2 < x \leq 3$	5	7	$3 < x \leq 4$	9	16	$4 < x \leq 5$	12	28	$5 < x \leq 6$	7	35	$6 < x \leq 7$	5	40	$7 < x \leq 8$	0	40	✓16 ✓40 (2)
Screen time (hours)	Frequency	Cumulative Frequency																											
$0 < x \leq 1$	0	0																											
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$7 < x \leq 8$	0	40																											
1.2	Screen time(in hours)/Skermtyd (in ure)	✓grounding/anker ✓using cumulative values/gebruik van kumulatiewe waardes (2)																											
1.3	$Q_2 = 4,3$ Accept/aanvaar 4,2 to 4,4	✓ answer/antwoord (1)																											
1.4	$\bar{x} < Q_2$ Data skew to left/Data is skeef na links	✓ $\bar{x} < Q_2$ ✓conclusion/gevolgtrekking (2)																											
1.5	new/nuwe $\bar{x} = \frac{(1,5 \times 2) + (2,5 \times 5) + (3,5 \times 33)}{40}$ $= \frac{131}{40}$ $= 3,275$	✓131 ✓answer/antwoord (2)																											
		[9]																											

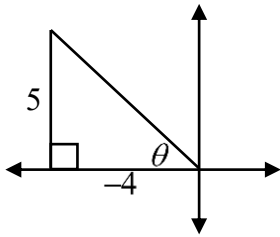
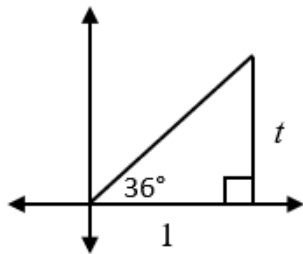
QUESTION/VRAAG 2		
2.1	G20 SUMMIT/BERAAD 2025  CO₂ EMISSIONS PER CAPITA (TONNES PER PERSON) GPD PER CAPITA (USD)/BBP PER CAPITA (USD)	✓4 points correct/4 punte korrek ✓all points correct/alle punte korrek (2)
2.2	$a = 6,1289$ $b = 0,0001$ $y = 6,1289 + 0,0001x$	✓value/waarde a ✓value/waarde b ✓equation/vergeliking (3)
2.3	$r = 0,47$	✓answer/antwoord (1)
2.4	Moderate correlation/Matige korrelasie	✓answer/antwoord (1)
2.5	$y = 6,1289 + 0,0001(40000)$ $y = 10,1289$	✓subst/vervang ✓answer/antwoord (2)
2.6	No, some countries are more developed than others and that can influence the Gross Domestic Product (GDP) per capita Or some countries are more densely populated than others. <i>Nee, sommige lande is meer ontwikkel as ander en dit kan die Bruto Binnelandse Produk (BBP) per capita beïnvloed</i> <i>Of sommige lande is digter bevolk as ander.</i>	✓answer/antwoord (1)
		[10]

QUESTION/VRAAG 3

3.1	$x_M = \frac{-2+2}{2} \quad y_M = \frac{-3+1}{2}$ $x_M = 0 \quad y_M = -1$	✓ value x / waarde x ✓ value y / waarde y (2)
3.2	$y - y_1 = m(x - x_1) \quad m(BP) = \frac{-4 - (-1)}{3 - 0} = -1$ $y - (-4) = -1(x - 3) \quad \text{or/of} \quad y - (-1) = -1(x - 0)$ $y + 4 = -x + 3 \quad y + 1 = -x$ $y = -x - 1 \quad y = -x - 1$	✓ $m(AP)$ ✓ subst in formula / vervang in formule ✓ answer / antwoord (3)
3.3	$m(AD) = \frac{-3 - 1}{-2 - 2} = 1$ $m(AD) \times m(BP)$ $= 1 \times -1$ $= -1$ $\therefore BP \perp AD$	✓ $m(AD)$ ✓ subst in formula / vervang in formule (2)
3.4	$m(AD) = m(BC)$ $1 = \frac{-4 - r}{3 - 4}$ $-1 = -4 - r$ $r = -3$	✓ $m(BC)$ ✓ equate gradients / gelykstel ✓ answer / antwoord (3)

3.5	$\tan \theta = m(\text{BD})$ $\tan \theta = \frac{-4-1}{3-2}$ $\tan \theta = -5$ $\theta = 180^\circ - 78,69^\circ$ $\theta = 101,31^\circ$	$\checkmark$ subst in formula/ vervang in formule $\checkmark -5$ $\checkmark 180^\circ - 78,69^\circ$ $\checkmark$ answer/antwoord (4)
3.6	AC: $y = -3 \dots\dots \textcircled{1}$ BD: $y - y_1 = m(x - x_1)$ $m(\text{BD}) = -5$ $y - (-4) = -5(x - 3)$ or/of $y - 1 = -5(x - 2)$ $y + 4 = -5x + 15$ $y - 1 = -5x + 10$ $y = -5x + 11$ $y = -5x + 11 \dots\dots \textcircled{2}$ Subst $\textcircled{1}$ into $\textcircled{2}$: $-3 = -5x + 11$ $5x = 14$ $x = \frac{14}{5}$ $S\left(\frac{14}{5}; -3\right)$	$\checkmark$ equation AC/vergeliking AC $\checkmark m(\text{BD})$ $\checkmark$ equation BD/vergeliking BD $\checkmark$ equating/gelykstel $\checkmark$ value x /waarde x (5)
3.7	$AB = \sqrt{(-2-3)^2 + (-3-(-4))^2}$ $= \sqrt{26}$ $BD = \sqrt{(3-2)^2 + (-4-1)^2} = \sqrt{26}$ $AB = BD$ $\therefore \triangle ABD$ is isosceles/gelykbenig	$\checkmark$ subst in distance formula/ vervang in afstand formule $\checkmark$ length AB/lengte AB $\checkmark$ length BD/lengte BD $\checkmark$ conclusion/gevolgtrekking (4)
3.8	Trapezium one pair of sides parallel Trapezium een paar sye ewewydig	$\checkmark$ answer/antwoord $\checkmark$ reason/rede (2)
		[25]

QUESTION/VRAAG 4		
4.1	$\tan P = \frac{1}{3}$ $\hat{P} = 18,43^\circ$ $Q\hat{P}V = 18,43^\circ - 4,4^\circ$ $Q\hat{P}V = 14,03^\circ$	✓ subst in tan def/vervang in tan def ✓ size $\hat{P}$ /grootte $\hat{P}$ ✓ $18,43^\circ - 4,4^\circ$ ✓ $14,03^\circ$ (4)
4.2	$\hat{Q} = 90^\circ$ rad $\perp$ tan In $\triangle PQV$: $\tan 14,03^\circ = \frac{QV}{8\sqrt{10}}$ $QV = 6,32$ $\therefore$ rad = 6,32	✓ state 90° /stel 90° ✓ tan def/vervang in tan def ✓ radius (3)
4.3	$(x-a)^2 + (y-b)^2 = r^2$ through/deur $(0 ; 0)$ $(0-6)^2 + (0-b)^2 = (6,32)^2$ $36 + b^2 = 39,9424$ $b^2 = 3,9424$ $b = 2$ Centre/midpunt $(6 ; 2)$	✓ a – value/a – waarde ✓ substitution $(0, 0)$ /vervang ✓ subst radius/vervang rad ✓ b – value/b – waarde (4)
4.4	$S(-16 ; -2)$	✓ value x /waarde x ✓ value y /waarde y (2)
		[13]

QUESTION/VRAAG 5		
5.1.1	$\tan \theta = -\frac{5}{4}$ $r = \sqrt{41}$ $\sin(180^\circ + \theta)$ $= -\sin \theta$ $= \frac{5}{\sqrt{41}}$	 $\checkmark$ value r/waarde r $\checkmark$ reduction/reduksie $\checkmark$ answer/antwoord (3)
5.1.2	$\sqrt{41} \cos \theta - 4 \sin(-150^\circ) \cdot \cos 180^\circ$ $= \sqrt{41} \cos \theta + 4 \sin 150^\circ (-1)$ $= \sqrt{41} \cos \theta + 4(\sin 30^\circ)(-1)$ $= \sqrt{41} \left(-\frac{4}{\sqrt{41}}\right) + 4\left(\frac{1}{2}\right)(-1)$ $= -4 - 2$ $= -6$	$\checkmark \sin 30^\circ$ $\checkmark \frac{1}{2}$ and/en -1 $\checkmark -\frac{4}{\sqrt{41}}$ $\checkmark$ answer/antwoord (4)
5.2	$a \in [-1 ; 1]$	$\checkmark$ answer/antwoord (1)
5.3.1	$r = \sqrt{t^2 + 1}$ $\frac{1}{\sin 306^\circ}$ $= \frac{1}{-\sin 54^\circ}$ $= 1 \div -\left(\frac{1}{\sqrt{t^2 + 1}}\right)$ $= -\sqrt{t^2 + 1}$ OR/OF $= \frac{1}{-\sin 54^\circ}$ $= \frac{1}{-\cos 36^\circ}$ $= 1 \div -\left(\frac{1}{\sqrt{t^2 + 1}}\right)$ $= -\sqrt{t^2 + 1}$	 $\checkmark -\sin 54^\circ$ $\checkmark$ substitution/vervangings $\checkmark$ answer/antwoord (3)
	$= \frac{1}{-\sin 54^\circ}$ $= \frac{1}{-\cos 36^\circ}$ $= 1 \div -\left(\frac{1}{\sqrt{t^2 + 1}}\right)$ $= -\sqrt{t^2 + 1}$	$\checkmark -\sin 54^\circ$ $\checkmark$ substitution/vervangings $\checkmark$ answer/antwoord (3)

5.3.2	$\begin{aligned} &\tan 81^\circ \\ &= \frac{\sin 81^\circ}{\cos 81^\circ} \\ &= \frac{\sin(45^\circ + 36^\circ)}{\cos(45^\circ + 36^\circ)} \\ &= \frac{\sin 45^\circ \cos 36^\circ + \cos 45^\circ \sin 36^\circ}{\cos 45^\circ \cos 36^\circ - \sin 45^\circ \sin 36^\circ} \\ &= \frac{\left(\frac{\sqrt{2}}{2}\right)\left(\frac{1}{\sqrt{t^2+1}}\right) + \left(\frac{\sqrt{2}}{2}\right)\left(\frac{t}{\sqrt{t^2+1}}\right)}{\left(\frac{\sqrt{2}}{2}\right)\left(\frac{1}{\sqrt{t^2+1}}\right) - \left(\frac{\sqrt{2}}{2}\right)\left(\frac{t}{\sqrt{t^2+1}}\right)} \\ &= \frac{\left(\frac{\sqrt{2}}{2}\right)\left(\frac{1}{\sqrt{t^2+1}}\right)(1+t)}{\left(\frac{\sqrt{2}}{2}\right)\left(\frac{1}{\sqrt{t^2+1}}\right)(1-t)} \end{aligned}$	✓ quotient identity/kwosiënt identiteit ✓ $45^\circ + 36^\circ$ ✓ expansion/uitbreiding ✓ substitution numerator/ vervangings teller ✓ substitution denominator/ vervangings noemer (5)
		[15]

QUESTION/VRAAG 6		
6.1.1	$\text{LHS} = 2 \cos \theta \cdot \cos 2\theta + \frac{\sin^2 2\theta}{\cos \theta}$ $\text{LHS} = 2 \cos \theta (2 \cos^2 \theta - 1) + \frac{(2 \sin \theta \cos \theta)^2}{\cos \theta}$ $\text{LHS} = 4 \cos^3 \theta - 2 \cos \theta + \frac{4 \sin^2 \theta \cos^2 \theta}{\cos \theta}$ $\text{LHS} = 4 \cos^3 \theta - 2 \cos \theta + 4 \sin^2 \theta \cos \theta$ $\text{LHS} = 2 \cos \theta (2 \cos^2 \theta - 1 + 2 \sin^2 \theta)$ $\text{LHS} = 2 \cos \theta (2 - 1)$ $\text{LHS} = 2 \cos \theta$	✓ cos double angle/cos dubbelhoek ✓ sin double angle/sin dubbelhoek ✓ simplification/vereenv ✓ simplification/vereenv ✓ common factor/gemeensk faktor ✓ 2 (6)
6.1.2	$x = \{90^\circ\}$	✓ 90° (1)
6.2	$\cos \theta = \frac{1}{\cos \theta} + \frac{5}{6}$ $6 \cos^2 \theta = 6 + 5 \cos \theta$ $6 \cos^2 \theta - 5 \cos \theta - 6 = 0$ $(3 \cos \theta + 2)(2 \cos \theta - 3) = 0$ $3 \cos \theta + 2 = 0 \quad \text{or/of} \quad 2 \cos \theta - 3 = 0$ $\cos \theta = -\frac{2}{3} \quad \text{or/of} \quad \cos \theta = \frac{3}{2}$ NA $\theta = 180^\circ - 48,19^\circ + k \cdot 360^\circ \text{ or/of } \theta = 180^\circ + 48,19^\circ + k \cdot 360^\circ$ $\theta = 131,81^\circ + k \cdot 360^\circ, k \in \mathbb{Z} \text{ or/of } \theta = 228,19^\circ + k \cdot 360^\circ, k \in \mathbb{Z}$	✓ LCM/KGV ✓ standard form/std vorm ✓ factors/faktore ✓ both equations/albei vgl's ✓ $131,81^\circ$ and/en $228,19^\circ$ ✓ $k \cdot 360^\circ, k \in \mathbb{Z}$ (6)
6.3	$\text{area/opv } \Delta PQR = \frac{1}{2} pq \sin R \dots\dots ①$ $\frac{p}{\sin P} = \frac{q}{\sin Q}$ $p = \frac{q \sin P}{\sin Q} \dots\dots ②$ $\text{Subs } ② \text{ into } ①: \text{ area/opv } \Delta PQR = \frac{1}{2} \left(\frac{q \sin P}{\sin Q} \right) q \sin R$ $\text{area/opv } \Delta PQR = \frac{q^2 \sin P \sin R}{2 \sin Q}$	✓ $p = \frac{q \sin P}{\sin Q}$ ✓ substitution/vervang (2)
		[15]

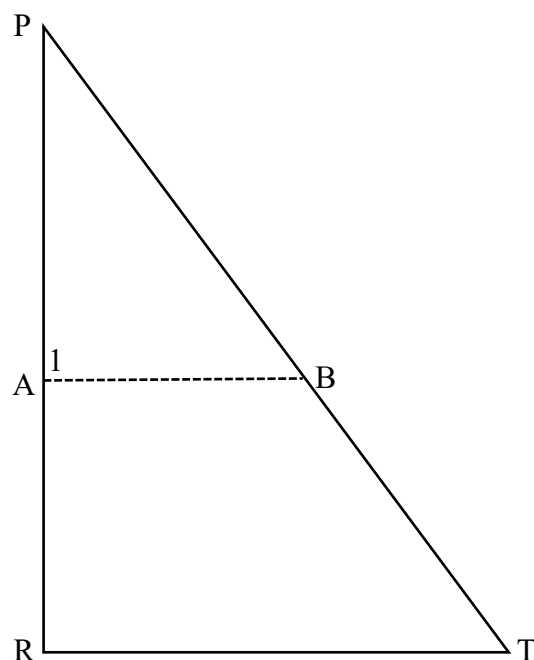
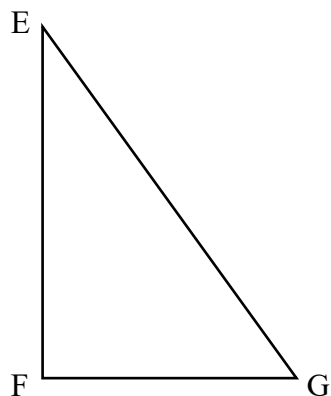
QUESTION/VRAAG 7		
7.1.1	$\cos(\alpha - \beta) = \cos \alpha \cos \beta + \sin \alpha \sin \beta$	✓ answer/antwoord (1)
7.1.2	$\sin 2\alpha$ $= \cos(90^\circ - (\alpha + \alpha))$ $= \cos(90^\circ - \alpha - \alpha)$ $= \cos((90^\circ - \alpha) - \alpha)$ $= \cos(90^\circ - \alpha) \cos \alpha + \sin(90^\circ - \alpha) \sin \alpha$ $= \sin \alpha \cos \alpha + \cos \alpha \sin \alpha$ $= 2 \sin \alpha \cos \alpha$	✓ $90^\circ - (\alpha + \alpha)$ ✓ expansion/uitbreiding ✓ co-functions/ ko-funksies (3)
7.2.1	In $\triangle PNR$: $\sin \theta = \frac{r}{b}$ $r = b \sin \theta \dots\dots ①$	✓ sin def ✓ r subject/r onderwerp (2)
7.2.2	$r = b \sin \theta \dots\dots ①$ $r = a \sin 2\theta \dots\dots ②$ From ① and ②: $b \sin \theta = a \sin 2\theta$ $b = \frac{a \sin 2\theta}{\sin \theta}$ $b = \frac{a(2 \sin \theta \cos \theta)}{\sin \theta}$ $b = 2a \cos \theta$	✓ equating/gelykstel ✓ b subject/b onderwerp ✓ sin double angle/sin dubbelhoek (3)
7.2.3	$\cos \theta = \frac{PR}{b}$ $PR = b \cos \theta$ $\cos 2\theta = \frac{PQ}{a}$ $PQ = a \cos 2\theta$ $\therefore QR = PR - PQ$ $QR = b \cos \theta - a \cos 2\theta$ $QR = (2a \cos \theta) \cos \theta - a(2 \cos^2 \theta - 1)$ $QR = 2a \cos^2 \theta - 2a \cos^2 \theta + a$ $QR = a$	✓ $PR = b \cos \theta$ ✓ $PQ = a \cos 2\theta$ ✓ $QR = b \cos \theta - a \cos 2\theta$ ✓ substitution/vervang (4)
		[13]

QUESTION/VRAAG 8		
8.1	$a = 2$	$\checkmark a = 2$ (1)
8.2	$f(x) = \sin 2x$ $f\left(\frac{3x}{2}\right) = \sin 2\left(\frac{3x}{2}\right) = \sin 3x$ Period/Periode: 120°	$\checkmark \sin 3x$ $\checkmark$ answer/antwoord (2)
8.3	$\sqrt{\sin 2x - 1}$ Max/maks = 0	$\checkmark$ answer/antwoord (1)
8.4	$f(x) = \sin 2x$ shifted down/afgeskuif $\frac{1}{2}$ units/eenhede $h(x) = \sin 2x - \frac{1}{2}$	$\checkmark$ answer/antwoord (1)
8.5	$x = 15^\circ$ and/en $x = 75^\circ$	$\checkmark x = 15^\circ$ $\checkmark x = 75^\circ$ (2)
		[7]

QUESTION/VRAAG 9				
9.1	$\hat{B}_1 = 81^\circ$	$\angle$ at centre is $2 \times \angle$ at circumf/midpt $\angle = 2 \times \angle$ by omtrek	✓S	✓R (2)
9.2	$\hat{G}_1 = 81^\circ$	$\angle$'s in same segment/ $\angle$ 'e in dies segment	✓S	✓R (2)
9.3	$\hat{G}_1 = \hat{FED} = 81^\circ$	ext $\angle$ cyclic quad ext / buite $\angle$ kvh	✓S	✓S (3)
	$\hat{FED} = \hat{D}_1 = 81^\circ$	given/gegee	✓S	
				[7]

QUESTION/VRAAG 10

10.1



Draw AB with A on PR and B on PT so that $EF = PA$ and $EG = PB$
 /Trek AB met A op PR en B op PT sodat $EF = PA$ en $EG = PB$

In $\triangle EFG$ and/en $\triangle PAB$:

(i) $EF = PA$ constr/konstr

(ii) $EG = PB$ constr/konstr

(iii) $\hat{E} = \hat{P}$ given/gegee

$\triangle EFG \equiv \triangle PAB$ SAS/SHS

$\therefore \hat{F} = \hat{A}_1 \equiv \Delta$

But/maar: $\hat{F} = \hat{R}$ given/gegee

$\therefore \hat{A}_1 = \hat{R}$

$\therefore AB \parallel RT$ corresp $\angle$'s equal/ooreenk $\angle$ 'e gelyk

$\therefore \frac{PA}{PR} = \frac{PB}{PT}$ prop theorem $AB \parallel RT$ /eweredigh st $AB \parallel RT$

and/en $EF = PA$ constr/konstr

$EG = PB$ constr/konstr

$\therefore \frac{EF}{PR} = \frac{EG}{PT}$

✓ constr/konstr

✓ $\equiv$ proof/bewys

✓ R

✓ S ✓ R

✓ S

(6)

(c)	$ML = SL = 12 \quad \Delta SXL \equiv \Delta MXL$ $\therefore KS = 8$ $\frac{KS}{KM} = \frac{SX}{ML} \quad \Delta \text{'s}$ $\frac{8}{KX + XM} = \frac{XM}{12} \quad KX + XM \text{ and/en } SX = XM$ $XM(KX + XM) = 96$ $XM\left(\frac{5}{3}XS + XM\right) = 96 \quad \text{from/uit 10.2.2 (b)}$ $XM\left(\frac{5}{3}XM + XM\right) = 96$ $XM\left(\frac{8}{3}XM\right) = 96$ $XM^2 = 36$ $XM = 6$ OR/OF In ΔKML: $\cos L = \frac{20^2 + 12^2 - 16^2}{2(20)(12)}$ $\cos L = \frac{3}{5}$ $\hat{L} = 53,13^\circ$ $\therefore \hat{L}_1 = \hat{L}_2 = 26,57^\circ$ In ΔXML: $M = 90^\circ \quad \angle \text{ in semi circle}$ $\tan 26,57^\circ = \frac{XM}{12}$ $XM = 6$	✓S ✓S ✓S ✓subst/verv ✓answer/ antwoord (5) ✓Subs cos rule ✓$\frac{3}{5}$ ✓26,57° ✓S/R ✓answer/ antwoord (5)
		[18]

11.5	$LN^2 = NP^2 + LP^2$ $\therefore PL = 2 \times PK$ and/en $NP = MP$ $\therefore LN^2 = MP^2 + (2PK)^2$ $LN^2 = PK.PL + (2PK)^2$ $LN^2 = PK.2PK + (2PK)^2$ $LN^2 = 6PK^2$ $LN = \sqrt{6}PK$	Pythagoras given/gegee given/gegee 	$\sqrt{S}$ $\sqrt{S}$ $\sqrt{\text{Subst/Verv}}$ $\sqrt{\text{Simpl/}}$ vereenvoudig (4)
11.6	$\Delta NLP \parallel \Delta KLM$ $\therefore \frac{NL}{KL} = \frac{NP}{KM}$ $NP = \frac{KM.NL}{KL}$ $NP = \frac{KM.\sqrt{6}PK}{KL}$ $PK = KL$ $NP = \sqrt{6}KM$	$\parallel \Delta$'s $LN = \sqrt{6}PK$ proven /bewys given/gegee	$\sqrt{S/R}$ $\sqrt{S}$ $\sqrt{S}$ (3)
			[17]

TOTAL/ *TOTAAL*: 150