basic education
Department
Basic Education
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Candidate Barcode label/Stafieskodeplakker

NSC Answer Book
NSS-antwoordeboek

Annotated by Tam.

National Senior Certificate/*Nasionale Senior Sertifikaat* (Grade 12/*Graad 12*) – November 2022

CENTRE NUMBER / *SENTRUMNOMMER*	
EXAMINATION NUMBER / *EKSAMENNOMMER*	
DATE / *DATUM*	
BOOK NUMBER / *BOEKNOMMER*	OF / *VAN*	BOOKS / *BOEKE*
SUBJECT CODE / *VAKKODE*	
PAPER NUMBER / *VRAESTELNOMMER*	2
SUBJECT NAME / *VAKNAAM*	MATHEMATICS/*WISKUNDE*

MARKER/*NASIENER*				MODERATOR'S INITIALS IN RELEVANT BLOCK / *MODERATOR SE VOORLETTERS IN RELEVANTE BLOKKIE*											
Question / *Vraag*	Marks / *Punte*	Marker's Code & Initials / *Nasiener se kode & Voorletters*	Marks / *Punte*	SM	Marks / *Punte*	DCM / *AHN*	Marks / *Punte*	CM / *HN*	Marks / *Punte*	IM	Marks / *Punte*	EM
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
		TOTAL / *TOTAAL*										

CONTROLLED AND CERTIFIED CORRECT (SURNAME AND INITIALS OF EA) / *GEKONTROLEER EN AS KORREK GESERTIFISEER (VAN EN VOORLETTERS VAN EA)*		READ INSTRUCTIONS ON THE NEXT PAGE. / *LEES INSTRUKSIES OP VOLGENDE BLADSY.*

This answer book consists of 23 pages./*Hierdie antwoordeboek bestaan uit 23 bladsye.*

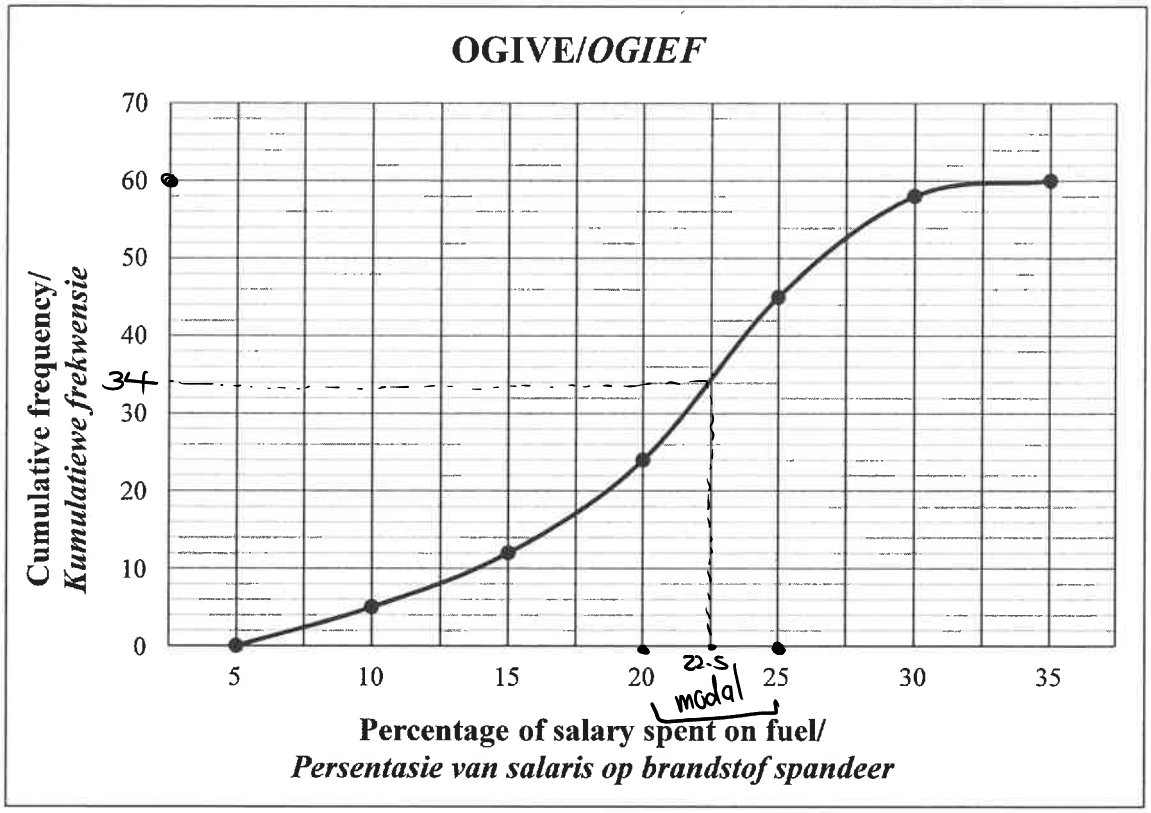
PLEASE FOLLOW THESE INSTRUCTIONS CAREFULLY	*VOLG ASSEBLIEF HIERDIE INSTRUKSIES NOUKEURIG*
1. Clearly write your examination number and centre number in the space provided and attach your barcode label in the space provided.	1. *Skryf jou eksamennommer en sentrumnommer duidelik in die ruimtes verskaf en plak jou stafieskodeplakker in die ruimte verskaf.*
2. Remember that your own name (or the name of your school) may not appear anywhere on or in this answer book.	2. *Onthou dat jou eie naam (of die naam van jou skool) nie op of in hierdie antwoordeboek mag voorkom nie.*
3. Answer ALL questions in the spaces provided.	3. *Beantwoord ALLE vrae in die ruimtes wat voorsien is.*
4. No pages may be torn from this answer book.	4. *Geen bladsye mag uit hierdie antwoordeboek geskeur word nie.*
5. Read the instructions printed on your timetable carefully as well as any other instructions which may be given in each examination paper.	5. *Lees die instruksies wat op jou eksamenrooster gedruk is, sorgvuldig deur, asook enige ander instruksies wat op elke eksamenvraestel gegee word.*
6. Candidates may not retain an answer book or remove it from the examination room.	6. *Geen antwoordeboek mag deur die kandidaat behou of uit die eksamenlokaal verwyder word nie.*
7. Answers must be written in black/blue ink as distinctly as possible. Do not write in the margins.	7. *Skryf die antwoorde so duidelik moontlik met swart/blou ink. Laat die kantlyne oop.*
8. Write the numbers of the questions you have answered on the front cover of the answer book where marks are to be recorded.	8. *Skryf die nommers van die vrae wat jy beantwoord het op die voorblad van die antwoordeboek waar die punte aangebring word.*
9. If you require additional space for your answers: 9.1 Use the additional space provided at the end of the answer book. 9.2 When answering a question in the additional space, indicate clearly the question number in the column on the LHS. 9.3 Rule off after each answer.	9. *In geval jy bykomende ruimte benodig vir jou antwoorde:* *9.1 Gebruik die bykomende ruimte wat aan die einde van die antwoordeboek voorsien word.* *9.2 As 'n vraag in die bykomende ruimte beantwoord word, dui duidelik die vraagnommer in die kolom aan die LK aan.* *9.3 Trek 'n lyn na elke antwoord.*
10. Draw a neat line through any work/rough work that must not be marked.	10. *Trek 'n netjiese lyn deur enige werk/rofwerk wat nie nagesien moet word nie.*

QUESTION/*VRAAG* 1

Popularity score (x)/ *Gewildheidspunt* (x)	32	89	35	82	50	59	81	40	79	65
Number of votes (y)/ *Getal stemme* (y)	9	22	10	21	11	15	20	12	19	16

	Solution/*Oplossing*	**Marks** *Punte*
1.1.1	$\bar{y} = \frac{9+22+10+21+11+15+20+12+19+16}{10}$ $= 15.5$	✓ (2)
1.1.2	$\sigma = 4.588\ldots$ ...calculator work $= 4.59$ (2 dec pl)	✓ (1)
1.2	$\bar{y} - \sigma = 15.5 - 4.59 = 10.91$ 2 were therefore not invited ∴ 10 − 2 were invited ∴ 8 learners were invited	✓ (2)
1.3	$a = 1.7709\ldots$ $b = 0.2243\ldots$ ...calculator work $\hat{y} = 0.22x + 1.77$	✓ (3)
1.4	let $x = 72$ $\hat{y} = 0.22(72) + 1.77$ $= 17.61$ ∴ ≈ 18 votes	✓ (2)
1.5.1	the points of the scatterplot are widely dispersed. there is a low correlation between IQ and number of votes	✓ (1)
1.5.2	$r = 0.9836\ldots$ ...calculator work ≈ 0.98 ∴ votes to popularity correlation is very strong	✓ (1)
		[12]

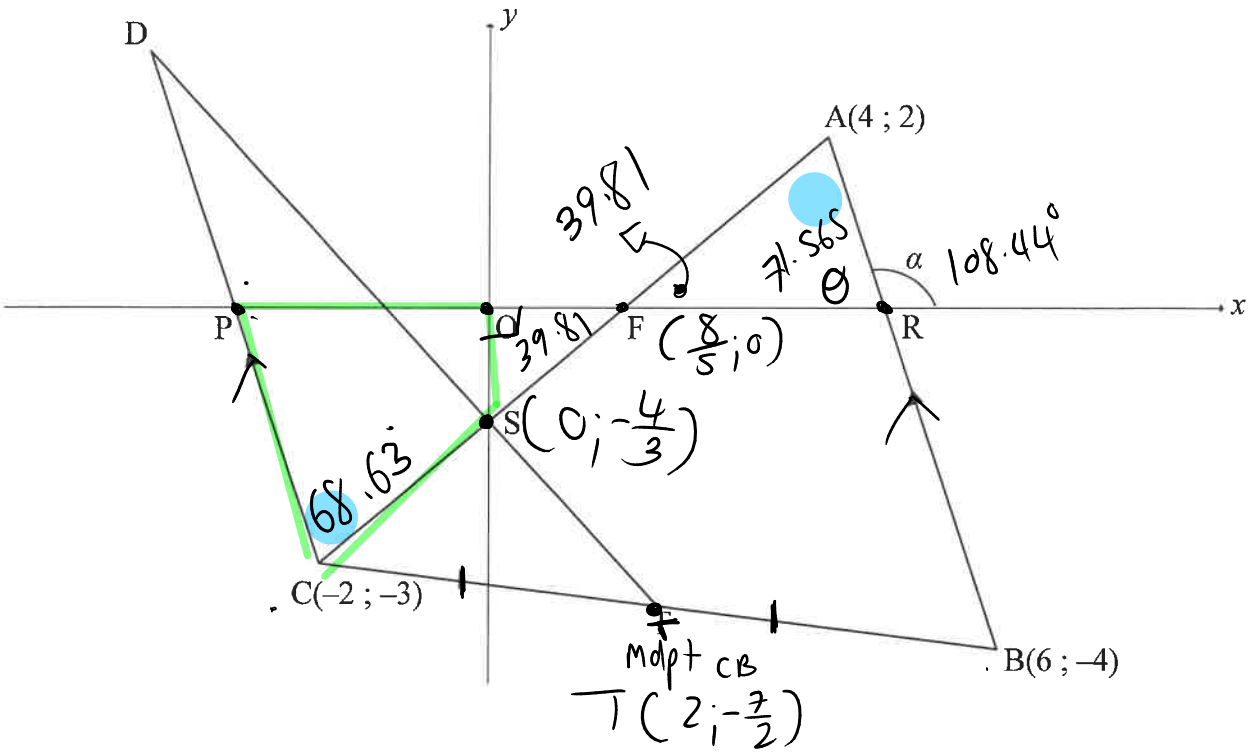
QUESTION/*VRAAG* 2



	Solution/*Oplossing*	Marks *Punte*
2.1	60 employees	✓ (1)
2.2	$20 < x < 25$ .. steepest part of the ogive	✓ (1)
2.3	more than 22.5%, 60 − 34 ∴ 26 people	✓ (2)
2.4	$x \times 7\% = 2400$ $\therefore x = \frac{2400}{7\%}$ $= 34285.71429\ldots$ ∴ R34285.71	✓ (2)

2.5	increase causes ogive to become steeper.	✓ (2)
		[8]

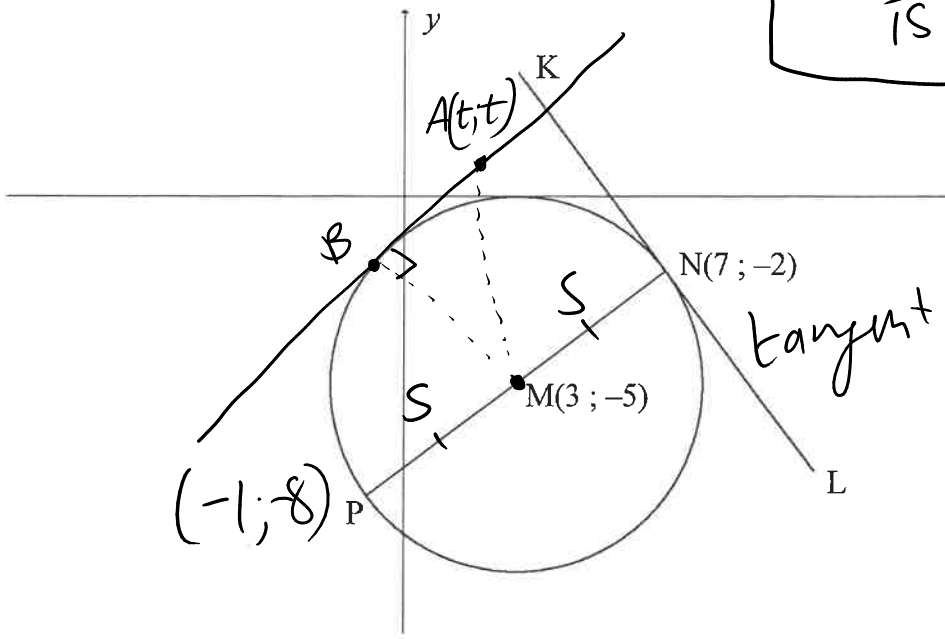
QUESTION/*VRAAG* 3



	Solution/*Oplossing*	Marks *Punte*
3.1.1	$\frac{y_2-y_1}{x_2-x_1} = \frac{2-(-4)}{4-6} = \frac{6}{-2} = -3$ $\therefore m_{AB} = -3$	✓ (2)
3.1.2	$\tan\theta = m_{AB}$ $\tan\theta = -3$ $\theta = \tan^{-1}(-3)$ $= (-)71.565\ldots$ $\therefore \alpha = 180 - \theta = 180 - 71.565\ldots = 108.44^\circ$	✓ marksheme 108.43° (2)
3.1.3	$T = \text{mdpt CB} = \left(\frac{x_1+x_2}{2}; \frac{y_1+y_2}{2}\right)$ $= \left(\frac{-2+6}{2}; \frac{-3+(-4)}{2}\right)$ $= \left(2; -\frac{7}{2}\right)$	✓ (2)

	Solution/*Oplossing*	Marks *Punte*
3.1.4	S: y int AC AC: $y = mx + c$ $m = \frac{-3-2}{-2-4}$ $= \frac{-5}{-6} = \frac{5}{6}$ $\therefore y = \frac{5}{6}x + c$ sub A(4;2) $2 = \frac{5}{6}(4) + c$ $c = -\frac{4}{3}$ $\therefore$ S$(0; -\frac{4}{3})$ ✓	(2)
3.2	$M_{CD} = M_{AB} = -3$ [CD ∥ AB] $\therefore y = -3x + c$ sub C(−2;−3) $-3 = -3(-2) + c$ $c = -9$ CD: $y = -3x - 9$ ✓	(3)
3.3.1	$\hat{DCA} = C\hat{A}B$ (alt ∠'s CD ∥ AB) $m_{AC} = \tan\theta$ $\theta = \tan^{-1}(\frac{5}{6})$ $= 39.81$ $\therefore 180 - 71.565 - 39.81$ (in ∠'s △ FAR) $\therefore \hat{DCA} \approx 68.63°$ marksch 68.62 ✓	(4)
3.3.2	Area POSC = Area△PFC − Area△POS A△PFC: $\frac{1}{2}(PC)(CF)\sin 39.81$ P: CD: $y = -3x - 9$ x-int; let y=0 $0 = -3x - 9$ $\frac{9}{-3} = x$ $\therefore$ P(−3;0) F: AC: $5x - 6y = 8$ (given) x-int; let y=0 $5x - 6(0) = 8$ $x = \frac{8}{5}$ $\therefore$ F$(\frac{8}{5};0)$ $\therefore PC = 3 + \frac{8}{5} = \frac{23}{5}$ $CF = \sqrt{(-2-\frac{8}{5})^2 + (-3-0)^2}$ $= \frac{3\sqrt{61}}{5}$ $\therefore$ Area PFC $= \frac{1}{2}(\frac{3\sqrt{61}}{5})(\frac{23}{5})\sin 39.81$	(5) **[20]**

QUESTION/*VRAAG* 4



$= 6.9u^2$

Area pos $= \frac{1}{2} \times b \times h$

$= \frac{1}{2}\left(\frac{8}{5}\right)\left(\frac{4}{3}\right)$

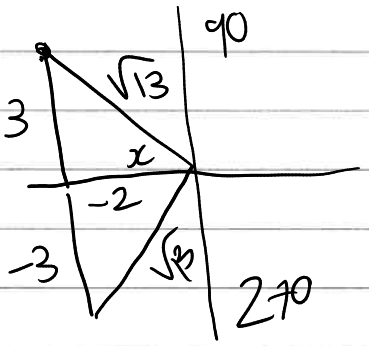
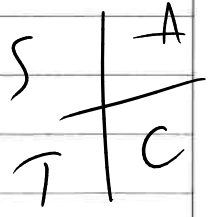
$= \frac{16}{15}u^2$ ∴ Area POSC $= 6.9 - \frac{16}{15}$ ✓

$= 5.83u^2$

	Solution/*Oplossing*	Marks *Punte*
4.1	$\frac{x_P + 7}{2} = 3$; $\frac{y_P + (-2)}{2} = -5$ …mdpt formula split ✓ $x_P = -1$; $y_P = -8$ ∴ $P(-1;-8)$	(2)
4.2.1	$r = \sqrt{(3-7)^2 + (-5+2)^2} = 5$ $(x-3)^2 + (y+5)^2 = 5^2$ $(x-3)^2 + (y+5)^2 = 25$ ✓	(3)
4.2.2	$m_{KL} \times m_{NP} = -1$ (tangent meets diam 90°) $m_{NP} = \frac{-5+2}{3-7} = \frac{-3}{4} = \frac{3}{4}$ ∴ $m_{KL} = -\frac{4}{3}$ ∴ KL: $y = -\frac{4}{3}x + c$ sub N(7;-2) $-2 = -\frac{4}{3}(7) + c$ $c = \frac{22}{3}$ ∴ $y = -\frac{4}{3} + \frac{22}{3}$ ✓	(5)

	Solution/*Oplossing*	**Marks** ***Punte***
4.3	secant: cuts circle twice $\therefore k < \frac{22}{3}$ AND up to POINT P $\therefore$ k at P: sub P into $y = -\frac{4}{3}x + k$ $-8 = -\frac{4}{3}(-1) + k$ $\therefore k > -\frac{28}{3}$ $k = -\frac{28}{3}$ $\therefore -\frac{28}{3} < k < \frac{22}{3}$ ✓	(4)
4.4.1	$AB^2 = AM^2 - MB^2$ (Pythag.) $= AM^2 - r^2$ $= \left(\sqrt{(t-3)^2 + (t+5)^2}\right)^2 - 5^2$ $= (t-3)^2 + (t+5)^2 - 25$ $= t^2 - 6t + 9 + t^2 + 10t + 25 - 25$ $AB^2 = 2t^2 + 4t + 9$ $AB = \sqrt{2t^2 + 4t + 9}$ ✓	(2)
4.4.2	min/max $f'(x) = 0$ $\therefore \frac{d(AB^2)}{dt} = 4t + 4 = 0$ $t = -1$ $AB^2 = 2(-1)^2 + 4(-1) + 9$ $= 7$ $AB = \sqrt{7}$ ✓	(4)
		[20]

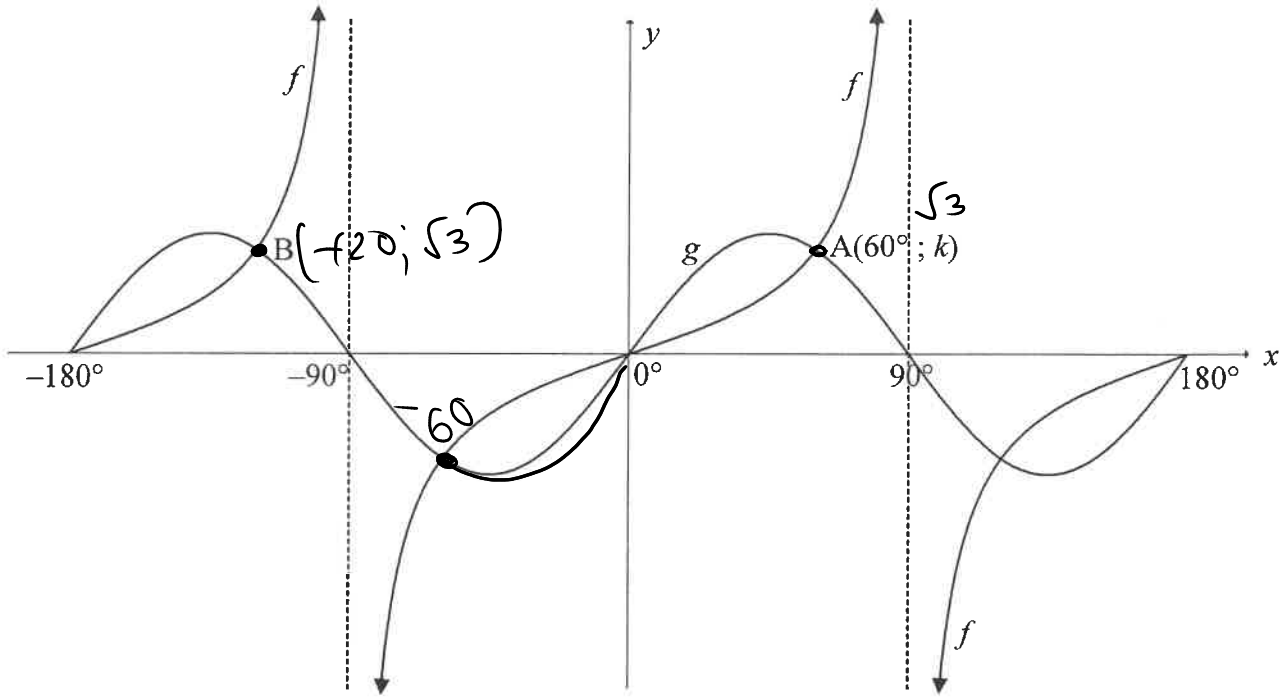
QUESTION/*VRAAG* 5

	Solution/*Oplossing*	**Marks** ***Punte***
5.1.1	$\sin x = \frac{-3}{\sqrt{13}}$ $\sin(360 + x) = \sin x$	differs from MS ✓ (2)
5.1.2	$\tan x = \frac{O}{A}$ $(\sqrt{13})^2 - (3)^2 = q^2$ $4 = q^2$ $q = \pm 2 \therefore -2$ $\therefore \tan x = \frac{3}{2}$ 	SOH CAH TOA ✓ (3)
5.1.3	$\cos(180 + x)$ $-\cos x = -\left(\frac{-2}{\sqrt{13}}\right) = \frac{2}{\sqrt{13}}$	differs from MS ✓ (2)
5.2	$-\frac{\sin\theta}{\sin\theta - 3\sin\theta}$ $= \frac{-\sin\theta}{-4\sin\theta}$ $= \frac{1}{4}$ 	✓ (5)

	Solution/*Oplossing*	**Marks** ***Punte***
5.3	$\cos x + 2\sin x = 0$ **or** $3\sin 2x - 1 = 0$ $2\sin x = -\cos x$ $\tan x = -\frac{1}{2}$ $x = \tan^{-1}(\pm)\frac{1}{2}$ RA: 26.565 $x = 180 - 26.565 + n180$ $= 153.43° + n180\ (n \in Z)$ **or** $x = 360 - 26.565 + n180$ $= 333.44° + n180\ (n \in Z)$ **or** $\sin 2x = \frac{1}{3}$ $2x = \sin^{-1}(\frac{1}{3}$ RA: 19.471 $x = \frac{180 - 19.471}{2} + \frac{n360}{2}$ **or** $x = \frac{19.471}{2} + \frac{n360}{2}$ $\therefore x = 80.26° + n180 (n \in Z)$ $\therefore x = 9.74° + n180\ (n \in Z)$	(6)
5.4.1	LHS $= [\cos x \cdot \cos y - \sin x \sin y][\cos x \cos y + \sin x \sin y]$ $= \cos^2 x \cos^2 y - \sin^2 x \sin^2 y$ $= (1 - \sin^2 x)(1 - \sin^2 y) - \sin^2 x \sin^2 y$ $= 1 - \sin^2 x - \sin^2 y + \sin^2 x \sin^2 y - \sin^2 x \sin^2 y$ $= 1 - \sin^2 x - \sin^2 y$ = RHS	(4)
5.4.2	$= \cos(45+15)\cos(45-15)$ $= \cos 30 \cos 60$ $= \left(\frac{\sqrt{3}}{2}\right)\left(\frac{1}{2}\right)$ $= \frac{\sqrt{3}}{4}$	(3)

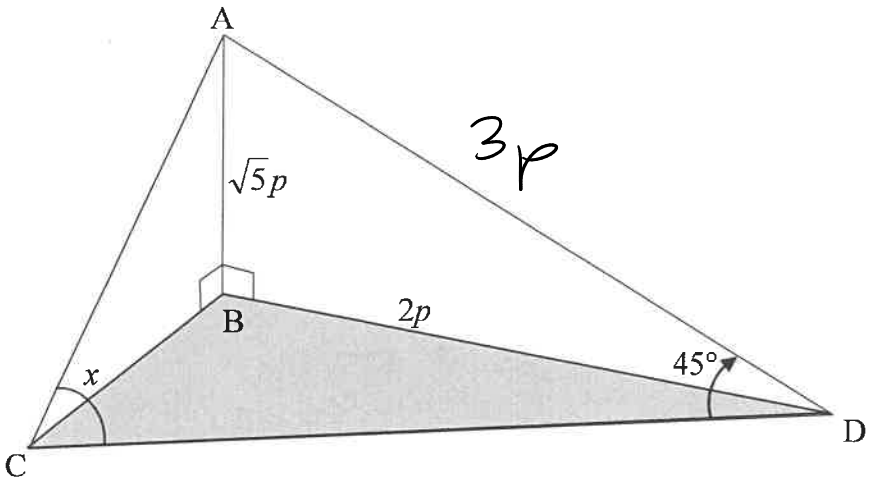
	Solution/*Oplossing*	**Marks** ***Punte***
5.5.1	$16\sin x\cos^3 x - 8\sin x\cos x$ $= 8\sin x\,(2\cos^3 x - \cos x)$ $= 8\sin x(\cos x)(2\cos^2 x - 1)$ $= 4.2\sin x\cos x.2\cos^2 x - 1$ $= 4.\sin 2x \;.\; \cos 2x$ $= 2.2\sin 2x\cos 2x$ $= 2\sin 2(2x)$ $2\sin 4x$ ✓	(4)
5.5.2	$\therefore x = 67{,}5°$ ✓ $270 \times \frac{1}{4}$ min	(1)
		[30]

QUESTION/*VRAAG* 6



	Solution/*Oplossing*	Marks *Punte*
6.1	180° ... by inspection	(1)
6.2.1	A(60; k) on g ∴ g(60) = 2sin2(60) ∴ k = √3	(1)
6.2.2	60 - 180 x = -120 g(-120) = √3 ∴ B(-120; √3)	(1)
6.3	2(2sin2x) = 4sin2x ∴ -4 ≤ y ≤ 4	(2)
6.4	g(x+5) ≤ 5(x+5) 5 units left $y_{g+5} \leq y_{f+5}$ $-65° \leq x \leq -5°$ ...by inspection	(2)
6.5	refer to MS	(3)
		[10]

QUESTION/*VRAAG 7*

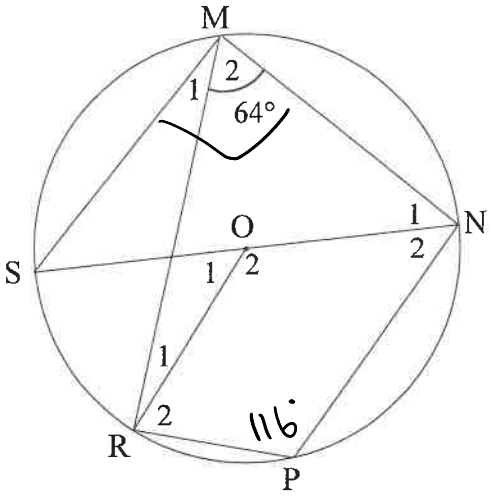


	Solution/*Oplossing*	Marks *Punte*
7.1	$AD^2 = (\sqrt{5}p)^2 + (2p)^2$ $= 5p^2 + 4p^2$ $= 9p^2$ $AD = 3p$ ✓	(2)
7.2	$\frac{3p}{\sin x} = \frac{CD}{\sin(180-(x+45))}$ $\frac{3p}{\sin x} \times \frac{\sin(x+45)}{1} = CD$ $CD = \frac{3p}{\sin x} \times \sin x\cos 45 + \cos x \sin 45$ $CD = \frac{3p}{\sin x} \times \sin x\left(\frac{1}{\sqrt{2}}\right) + \cos x\left(\frac{1}{\sqrt{2}}\right) = \frac{3p(\sin x + \cos x)}{\sqrt{2}\sin x}$ ✓	(5)
7.3	$CD = \frac{3(10)(\sin(110)+\cos(110))}{\sqrt{2}(\sin 110)}$ $AD = 3(10)$ $\therefore \text{Area} = \frac{1}{2}(CD)(AD)\sin 45$ $= \frac{1}{2} \times \left(\frac{30(\sin 110 + \cos 110)}{\sqrt{2} \times \sin 110}\right) \times 30 \times \sin 45$ $= 143.11\ m^2$ ✓	(3)
		[10]

Provide reasons for your statements in QUESTIONS 8, 9 and 10.
Verskaf redes vir jou bewerings in VRAAG 8, 9 en 10.

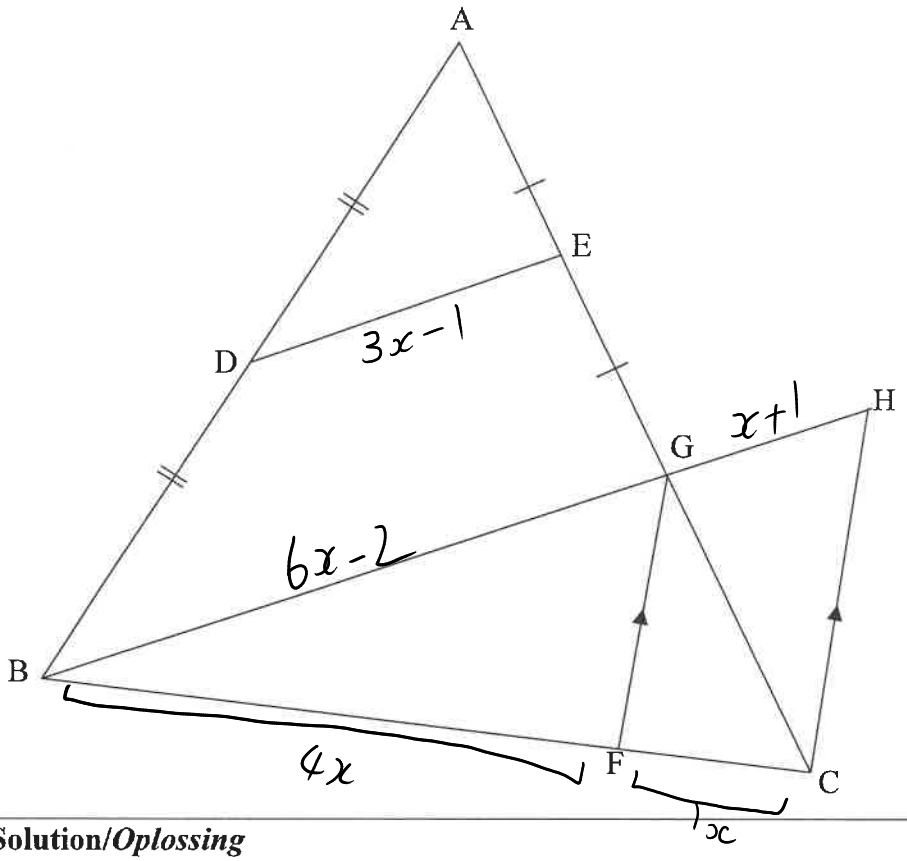
QUESTION/*VRAAG* 8

8.1



	Solution/*Oplossing*	Marks *Punte*
8.1.1	$\hat{P} = 180 - 64 = 116°$ (opp cs cyclic quad) ✓	(2)
8.1.2	$\hat{M}_1 = 90 - 64 = 26°$ (∠'s subtend by diam = 90) ✓	(2)
8.1.3	$O_1 = 26° \times 2$ (∠s at centre = 2× ∠ at circ) $= 52°$	(2)

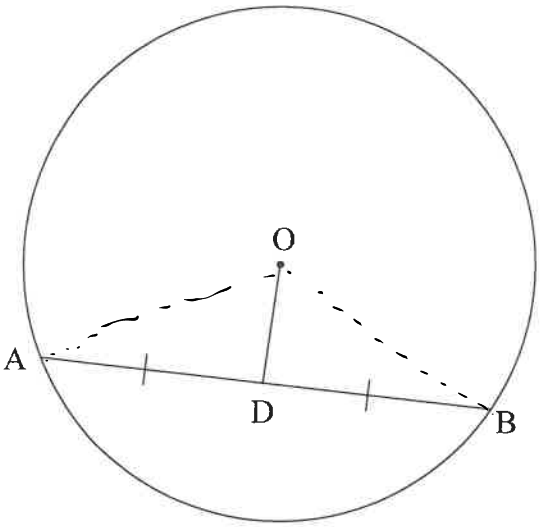
8.2



	Solution/*Oplossing*	Marks Punte
8.2.1	Mdpt thrm	✓ (1)
8.2.2	$DE = 3x+1 \therefore BG = 2(3x-1) = 6x-2$ (mdpt thrm) $\frac{BF}{FC} = \frac{BG}{GH}$ (prop thrm; FG ∥ CH) $\frac{4}{1} = \frac{6x-2}{x+1}$ $4x+4 = 6x-2$ $6 = 2x$ $x = 3$	✓ (6)
		[13]

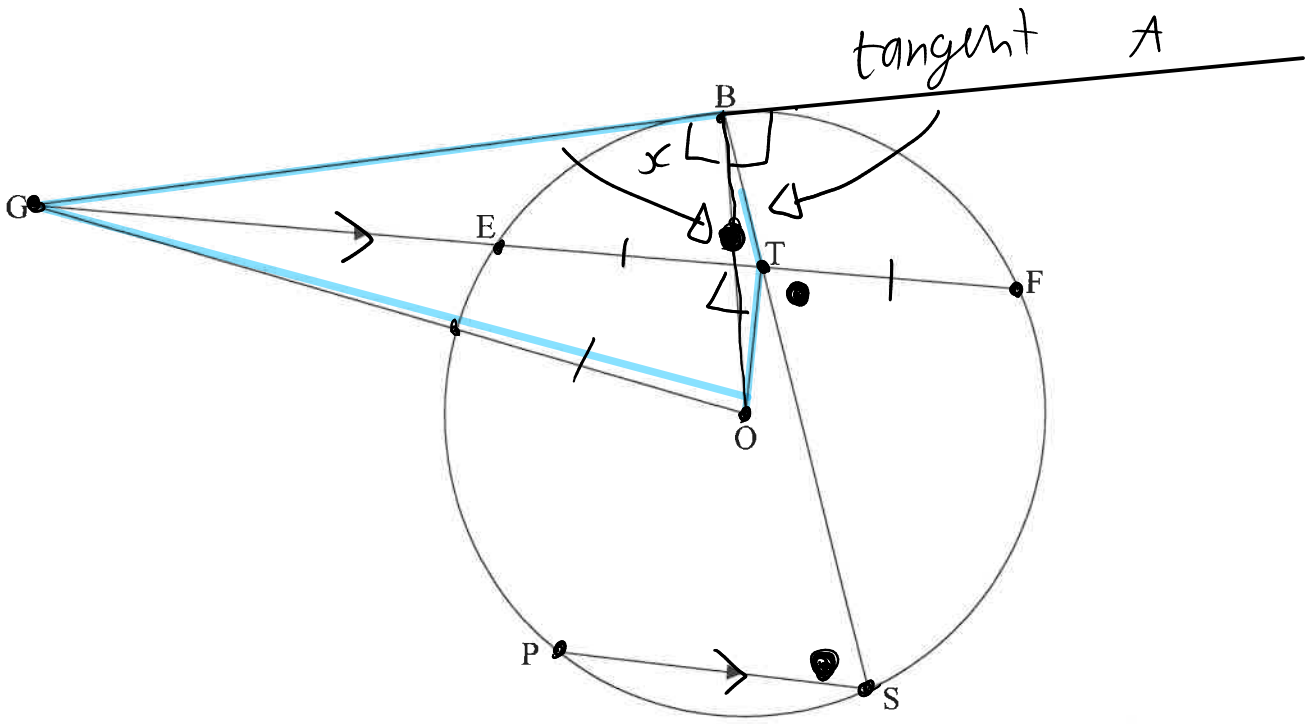
QUESTION/*VRAAG* 9

9.1



	Solution/*Oplossing*	**Marks** ***Punte***
9.1	Construct $OA \perp OB$ In $\triangle AOD$ and $\triangle BOD$ (1) $OA = OB$ (radii) (2) OD is common (3) $AD = DB$ (given) $\therefore \triangle AOD \equiv \triangle BOD$ [SSS] AOB is a str. line $\therefore \hat{D}_1 = \hat{D}_2$ ($\triangle AOD \equiv \triangle BOD$) $\therefore OB \perp AB$ ($\angle$'s on str. line $= 180^\circ$)	✓ (5)

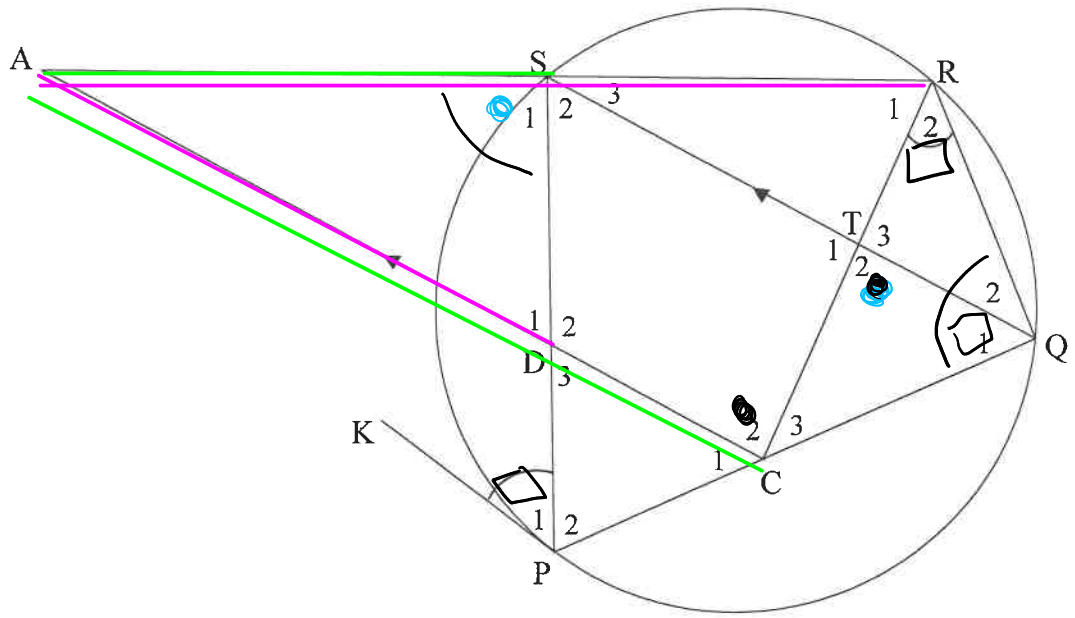
9.2



	Solution/*Oplossing*	**Marks** ***Punte***
9.2.1	$G\hat{B}O = 90°$ (tangent ⊥ radius) $O\hat{T}G = 90°$ (line from centre to mdpt chord) $\therefore O\hat{T}G = G\hat{B}O$ $\therefore$ OTBG is cyclic quad (angles subtended by equal line =) ✓	(5)

	Solution/*Oplossing*	**Marks** ***Punte***
9.2.2	$\hat{S} = S\hat{T}F$ (alt $\angle$'s; PS $\parallel$ GF) $E\hat{T}B = S\hat{T}F$ (vert. opp $\angle$'s) $G\hat{T}B = G\hat{O}B$ (cyclic quad OTBG; angles subtended by equal chord =) $\therefore \hat{S} = G\hat{O}B$	(4)
		[14]

QUESTION/*VRAAG* 10



	Solution/*Oplossing*	**Marks** ***Punte***
10.1	RTP: $S_1 = T_2$ $S_1 = Q_1 + Q_2$ (ext ∠s cyclic quad) $P_1 = Q_1$ (tan-chord thm) $P_1 = R_2$ (given) $T_2 = R_2 + Q_2$ (ext. ∠s △) but $R_2 = Q_1$ (proven) $\therefore T_2 = Q_1 + Q_2 = S_1$	✓ (4)

	Solution/*Oplossing*	**Marks** ***Punte***
10.2	RTP: $\frac{AD}{AR} = \frac{AS}{AC}$ ∴ $\triangle ASD$ and $\triangle ACR$ In $\triangle ASD$ and $\triangle ACR$ $\hat{A} = \hat{A}$ (common) $\hat{S}_1 = \hat{T}_2$ (proven) $T_2 = C_2$ (alt $\angle$s QS ∥ CA) ∴ $\triangle ASD \sim \triangle ACR$ (AAA) ∴ $\frac{AD}{AR} = \frac{AS}{AC}$ (sides in proportion)	(5)
10.3	RTP: $AC \times SD = AR \times TC$ $\frac{AC}{AR} = \frac{TC}{SD}$ ∴ $\triangle ACR$ and $\triangle ASD$ Proof: $\frac{AS}{AC} = \frac{SD}{CR}$ [$\triangle ASD \sim \triangle ACR$] $\frac{AS}{AR} = \frac{CT}{CR}$ (prop thm TS ∥ CA)	(4)
		[13]

	Additional space/*Bykomende ruimte*	**Marks** ***Punte***

$\therefore AS = \frac{SD \times AC}{CK}$ OK $AS = \frac{CT \times AR}{CR}$

$\therefore \frac{SD \times AC}{CR} = \frac{CT \times AR}{CK}$

$\therefore SD \times AC = CT \times AR$

$\therefore AC \times SD = AR \times CT$ ✓

	Additional space/*Bykomende ruimte*	**Marks** ***Punte***

TOTAL/*TOTAAL*: 150

RE-MARK/RE-CHECK *HERMERK/HERSIEN*				
Question *Vraag*	Marks *Punte*			Initials *Voorletters*
1				
2				
3				
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6				
7				
8				
9				
10				
TOTAL *TOTAAL*				
HASH TOTAL *KAF-TOTAAL*				