MATHEMATICS – P2

LAST PUSH

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GRADE/*GRAAD* 12

SEPTEMBER 2026

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

MARKS/*PUNTE*: 150

This marking guideline consists of 17 pages.
Hierdie nasienriglyn bestaan uit 17 bladsye.

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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 a question, mark the crossed-out version.
- Consistency accuracy applies in ALL aspects of the marking guideline. Stop marking at the second calculation error.
- Assuming answers/values in order to solve a problem is NOT acceptable.

GEOMETRY	
S	A mark for a correct statement. (A statement mark is independent of a reason).
R	A mark for the correct reason. (A reason mark may only be awarded only if the statement is correct.
S/R	Award a mark if a statement and a reason are both correct.

NOTA:

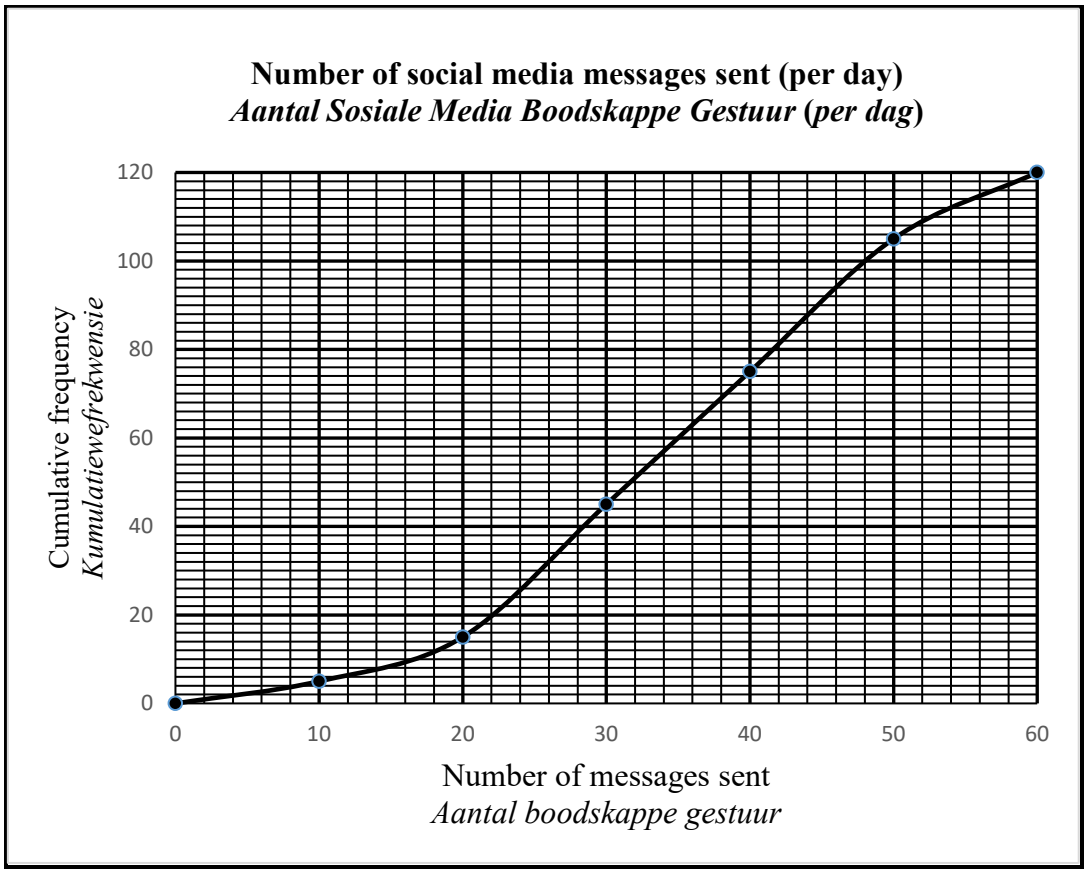
- *As 'n kandidaat 'n vraag TWEEKEER beantwoord, merk slegs die EERSTE poging.*
- *As 'n kandidaat 'n poging van 'n vraag doodtrek en dit nie oordoen nie, merk die doodgetrekte poging.*
- *Volgehoue akkuraatheid word in ALLE aspekte van die nasienriglyn toegepas. Hou op nasien by die tweede berekeningsfout.*
- *Om antwoorde/waardes te aanvaar om 'n probleem op te los, word NIE toegelaat nie.*

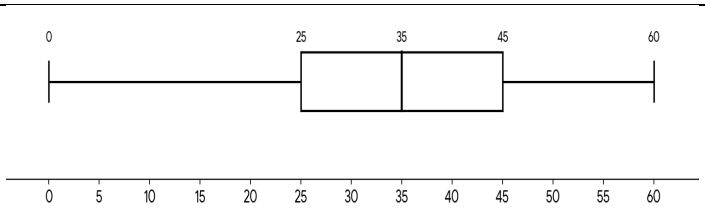
MEETKUNDE	
S	*'n Punt vir korrekte bewering.* (*'n Punt vir 'n bewering is onafhanklik van die rede*.)
R	*'n Punt vir 'n korrekte rede.* (*'n Punt word slegs vir die rede toegeken as die bewering korrek is*.)
S/R	*Ken 'n punt toe as die bewering en rede beide korrek is.*

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QUESTION/*VRAAG 1*



1.1	104 learners/*leerders*	✓✓ answer/*antwoord*	(2)
1.2	$Q_2 = 35$	✓✓ answer/*antwoord*	(2)
1.3	$Q_1 = 25 \quad Q_3 = 45$ IQR / $IKV = 45 - 25 = 20$	✓ Q_1 ✓Q_3 ✓ answer/*antwoord*	(3)
1.4	 **Number of messages sent / *Aantal boodskappe gestuur***	✓ correct min & max ✓ correct box and whisker diagram	(2)
1.5	mean > median which indicates that the data is positively skewed, meaning fewer learners sent significantly more messages than the rest. *gemiddelde > mediaan wat aandui dat die data positief skeef is, wat beteken dat minder leerders baie meer boodskappe as die res gestuur het.*	✓ mean > median *gemiddelde > mediaan* ✓ explanation *verduideliking*	(2)
			[11]

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QUESTION/*VRAAG 2*

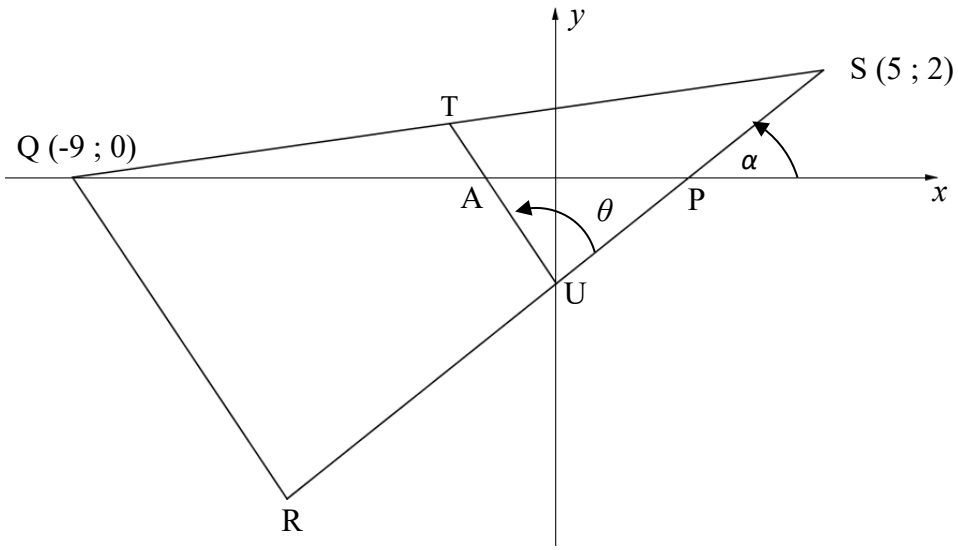
Learner / *Leerder*	1	2	3	4	5	6	7	8
Number of hours (*x*) *Aantal ure (x)*	5	12	15	20	25	30	42	45
Javelin distance (*y*) *Spiesgooi afstand (y)*	130	118	115	95	88	72	48	30

2.1	$\delta = 32{,}89$	✓✓ answer/*antwoord*	(2)
2.2	$r = -0{,}99$	✓ answer/*antwoord*	(1)
2.3	$a = 146{,}80 \quad b = -2{,}47$ $y = 146{,}80 - 2{,}47x$	✓ *a* ✓*b* ✓ answer/*antwoord*	(3)
2.4.1	$y = 146{,}80 - 2{,}47(35)$ $= 60{,}35$	✓ correct substitution *korrekte vervanging* ✓ answer/*antwoord*	(2)
2.4.2	No**,** as the strong negative correlation suggests that more gym training is associated with decreasing throwing distances. *Nee, soos die sterk negatiewe korrelasie voorstel dat meer gimnasium oefening word assosieer met afname in spiesgooi afstande.*	✓ for No / *vir Nee* ✓ explanation/ *verduideliking*	(2)
			[10]

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QUESTION/*VRAAG 3*



3.1	$x_T = \frac{-9+5}{2}; y_T = \frac{0+2}{2}$ $x_T = -2 \quad ; y_T = 1$ $T(-2;1)$	✓ $x_T = -2$ ✓ $y_T = 1$	(2)
3.2	$5y = 4(0) - 10$ $y = -2$ $U(0;-2)$	✓ $x = 0$ ✓ $y = -2$	(2)
3.3	$SU = \sqrt{(5-0)^2 + (2+2)^2}$ $= \sqrt{41}$	✓ correct substitution *korrekte vervanging* ✓ answer/*antwoord*	(2)
3.4	$y = -\frac{3}{2}x - \frac{27}{2}$ $m_{QR} = -\frac{3}{2}$ $m_{TU} = \frac{1+2}{-2-0}$ $= -\frac{3}{2}$ $\therefore QR \parallel TU \qquad [m_{QR} = m_{TU}]$	✓ m_{QR} ✓ correct substitution *korrekte vervanging* ✓ m_{TU}	(3)
3.5	$TU = \sqrt{(-2-0)^2 + (1+2)^2}$ $= \sqrt{13}$ $QR = 2TU = 2\sqrt{13}$ [line through midpt $\parallel$ to 2nd side] [*lyn deur middelpunt* $\parallel$ *aan 2de sy*]	✓ $TU = \sqrt{13}$ ✓ $QR = 2\sqrt{13}$	(2)

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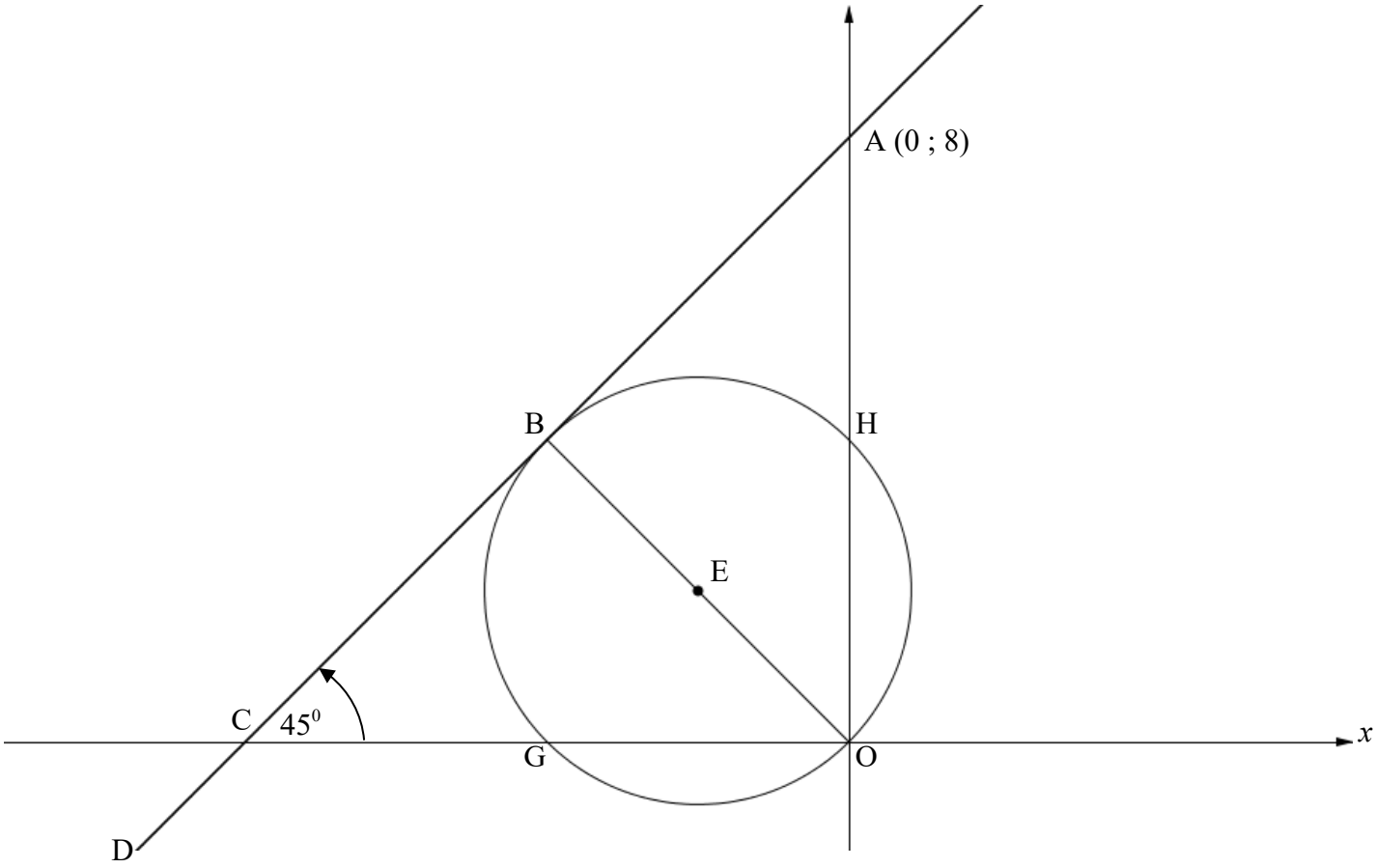
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3.6	$\tan T\hat{A}P = m_{TU} = -\frac{3}{2}$ $T\hat{A}P = 123.69^0$ $\tan\alpha = m_{SR} = \frac{4}{5}$ $\alpha = 38{,}66^0$ $\therefore \theta = 85.03^0$	✓ $\tan T\hat{A}P = m_{TU}$ ✓ inclination of TU *inklinasie van* TU ✓ inclination of SR *inklinasie van* SR ✓ answer/*antwoord*	(4)
3.7	$\hat{R} = \theta = 85.03^0$ [corresp.∠s:QR||TU] / [*ooreenk.∠e* : *QR* || *TU*] SR = 2SU [Midpoint *T*heorem.] / [*Middelpunt Stelling*] $\text{A. of}\Delta\text{SQR} = \frac{1}{2}\times \text{SR}\times \text{QR}\sin\text{R}$ $= \frac{1}{2}\times 2\sqrt{41}\times 2\sqrt{13}\times \sin 85{,}03^0$ $= 46$	✓ $\hat{R} = \theta$ ✓ SR=2SU ✓ correct substitution *korrekte vervanging* ✓ answer/*antwoord*	(4)
			[19]

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QUESTION/*VRAAG 4*



4.1	$m_{AD} = \tan 45^0 = 1$	✓ answer/*antwoord*	(1)
4.2	$m_{OB} = -1$ $0 = -1(0) + c$ $c = 0$ $\therefore y = -x$	✓ gradient of OB *gradiënt van* OB ✓ correct substitution *korrekte vervanging* O(0 ; 0) ✓ equation/*vergelyking*	(3)
4.3	$-x = x + 8$ $-2x = 8$ $x = -4$ $y = -(-4) = 4$ $B(-4;4)$	✓ equating equations *gelyk stel van vergelykings* ✓ *x*-coordinate / *x-koördinaat* ✓ *y*-coordinate/*y-koördinaat*	(3)
4.4	$OB = \sqrt{(0-(-4))^2 + (0-4)^2}$ $= 4\sqrt{2}$ $\therefore r = 2\sqrt{2}$	✓ correct substitution *korrekte vervanging* ✓ length of OB/*lengte van* OB ✓ radius/*radius*	(3)

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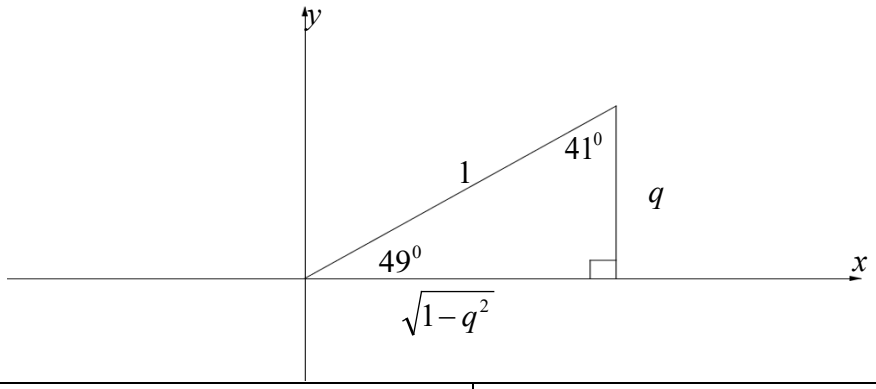
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4.5	$x_E = \frac{0-4}{2}$; $y_E = \frac{0+4}{2}$ $= -2$; $= 2$ $\therefore (x+2)^2 + (y-2)^2 = 8$	✓ x_E ✓ y_E ✓ LHS/*LK* ✓RHS/*RK*	(4)
4.6	$m_{\tan} = 1$ $y - 0 = 1(x - 0)$ [tangent passing through origin] [*raaklyn gaan deur die oorsprong*] $y = x$ $t = 0$ *or* $t = 8$	✓✓ answer/*antwoord*	(2)
4.7	$D_{\text{between 2 centres}} = \sqrt{(4+2)^2 + (8-2)^2}$ $= 6\sqrt{2} = 8{,}49$ $r_1 + r_2 = 2\sqrt{2} + 3 = 5{,}83$ $\therefore$ The 2 circles do not touch each other. $[D > r_1 + r_2]$ *Die 2 sirkels raak nie mekaar nie.*	✓ D between 2 centres *afstand tussen 2 middelpunte* ✓ $r_1 + r_2$ ✓ conclusion/ ✓ R *gevolgtrekking*	(4)
			[20]

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QUESTION/*VRAAG 5*

5.1.1			
	$1^2 = x^2 + q^2$ $x = \sqrt{1-q^2}$ $\tan 41^0 = \dfrac{\sqrt{1-q^2}}{q}$	✓ x from Pythagoras or diagram above *x vanaf Pythagoras of diagram hierbo* ✓answer/*antwoord*	(2)
5.1.2	$\cos 229^0 = -\cos 49^0$ $= -\sqrt{1-q^2}$	✓reduction/*reduksie* ✓answer/*antwoord*	(2)
5.1.3	$\sin 4^0 = \sin(49^0 - 45^0)$ $= \sin 49^0 \cos 45^0 - \sin 45^0 \cos 49^0$ $= q.\dfrac{\sqrt{2}}{2} - \dfrac{\sqrt{2}}{2}.\sqrt{1-q^2}$ $= \dfrac{\sqrt{2}\left(q - \sqrt{1-q^2}\right)}{2}$	✓ use of compound angles *gebruik van saamgestelde hoeke* ✓ expansion/*uitbreiding* ✓✓correct substitution for each term *korrekte vervanging vir elke term*	(4)
5.2	$f(x) = \dfrac{\sin(x-180^0).\sin(90^0+x)}{\sin^2 x - \cos^2(360^0 - x)}$ $= \dfrac{(-\sin x)(\cos x)}{\sin^2 x - (-\cos x)^2}$ $= \dfrac{-\sin x \cos x}{\sin^2 x - \cos^2 x}$ $= \dfrac{-\frac{1}{2}\sin 2x}{-(\cos^2 x - \sin^2 x)}$ $= \dfrac{-\frac{1}{2}\sin 2x}{-\cos 2x}$ $= \dfrac{1}{2}\tan 2x$	✓ $(-\sin x)$ ✓ $\cos x$ ✓ $(-\cos x)^2$ ✓ $\frac{1}{2}\sin 2x$ ✓ $-(\cos^2 x - \sin^2 x)$ ✓ $\cos 2x$ ✓ answer/*antwoord*	(7)
5.2.2	$x = -135^0$ *or / of* $x = -45^0$	✓ ✓ each x-value / *elke x-waarde*	(2)
			[17]

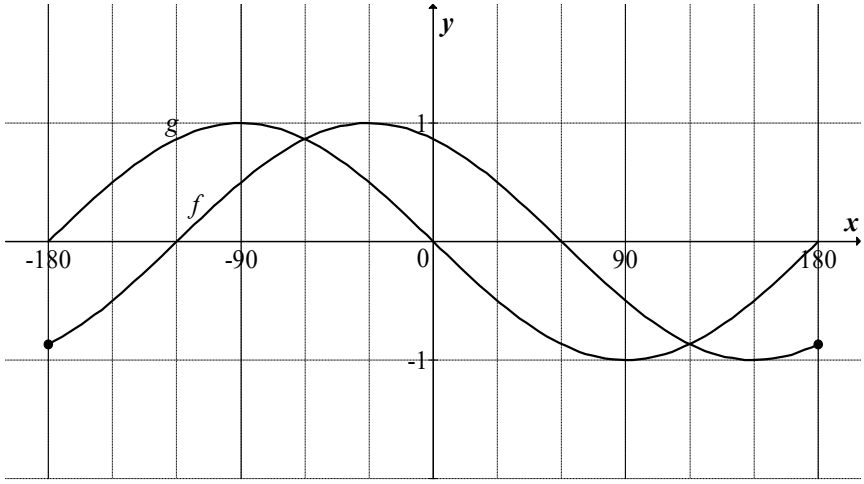
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QUESTION/*VRAAG 6*			
6.1	$\cos(A+B)=\cos(A-(-B))$ $=\cos A.\cos(-B)+\sin A\sin(-B)$ $=\cos A\cos B-\sin A\sin B$	✓ $\cos(A-(-B))$ ✓ expansion ✓ answer	(3)
6.2	$LHS=\dfrac{\sin 22^0.\cos 320^0+\sin 40^0\sin 68^0}{\sin 391^0.\cos 31^0}$ $=\dfrac{\cos 68^0.(\cos 40^0)+\sin 40\sin 68^0}{(\sin 31^0).\cos 31^0}$ $=\dfrac{\cos(68^0-40^0)}{\frac{1}{2}\sin 62^0}$ $=\dfrac{\cos 28^0}{\frac{1}{2}\sin 62^0}$ $=2.\dfrac{\sin 62^0}{\sin 62^0}$ $=2$	✓ $\cos 40^0$ ✓ $\cos 68^0$ ✓ $(\sin 31^0)$ ✓ $\cos(68^0-40^0)$ ✓ $\frac{1}{2}\sin 62^0$ ✓ $\sin 62^0$	(6)
6.3	$\cos 2x+5\sin x=3$ $1-2\sin^2 x+5\sin x-3=0$ $2\sin^2-5\sin x+2=0$ $(2\sin x-1)(\sin x-2)=0$ $\sin x=\dfrac{1}{2}$ *or / of* $\sin x\neq 2$ *ref. / verw.* $\angle=30^0$ $x=-330^0$ *or / of* $x=-210^0$	✓ $1-2\sin^2 x$ ✓standard form/*standaardvorm* ✓equations/*vergelykings* ✓✓ each x-value/*elke x-waarde*	(5)
			[14]

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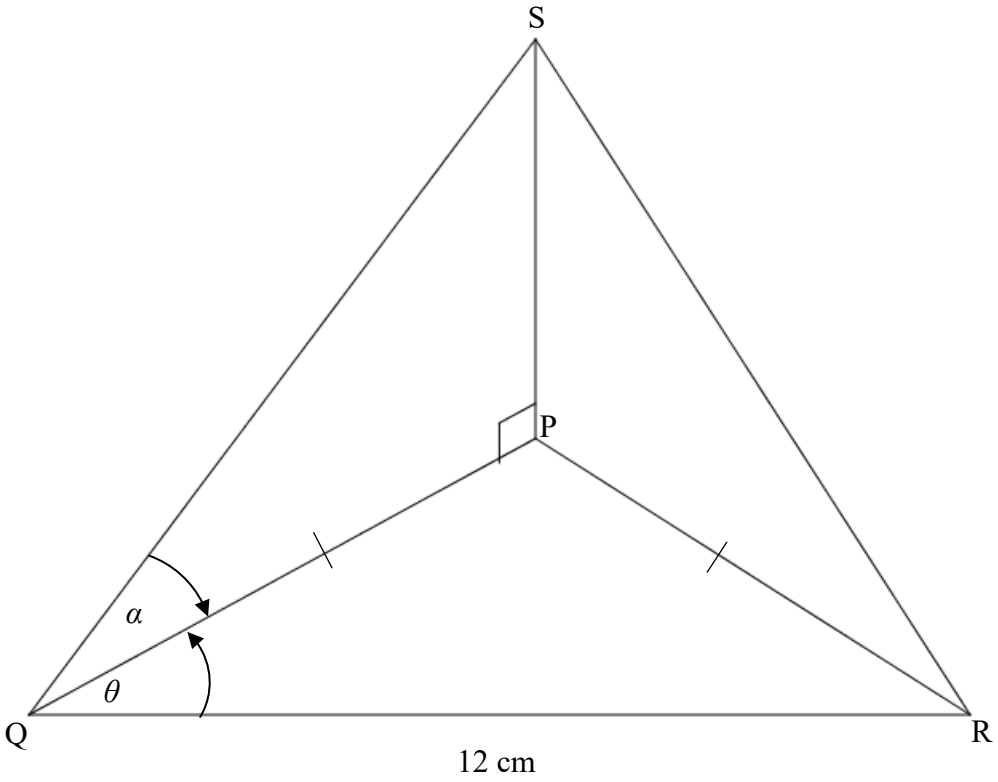
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QUESTION/*VRAAG 7*			
7.1	$a = 1$ $p = 30^0$	✓ value of a/ *waarde van a* ✓ value of p/ *waarde van p*	(2)
7.2	Period / *Periode* $= 360^0$	✓ answer/ *antwoord*	(1)
7.3		✓ correct TPs *Korrekte DPe* ✓ correct intercepts/ *korrekte afsnitte* ✓ shape/*vorm*	(3)
7.4	$x = -60^0$ *or / of* $x = 120^0$	✓ $x = -60^0$ ✓ $x = 120^0$	(2)
7.5	$-3 \le y \le -1$ **OR/*OF*** $y \in [-3\ ;\ -1]$	✓✓ correct answer /*korrekte antwoord*	(2)
			[10]

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QUESTION/*VRAAG 8*



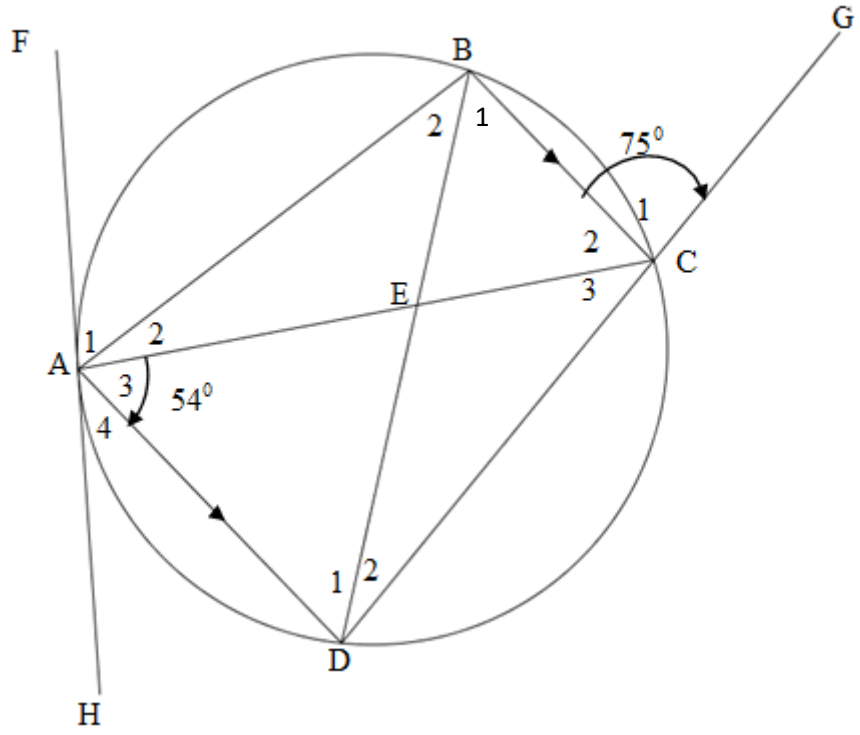
8.1	$\hat{QPR} = 180^0 - 2\theta$ $\frac{PQ}{\sin\theta} = \frac{12}{\sin(180^0 - 2\theta)}$ $PQ = \frac{12\sin\theta}{\sin 2\theta}$ $= \frac{12\sin\theta}{2\sin\theta.\cos\theta}$ $= \frac{6}{\cos\theta}$ $\frac{PQ}{SQ} = \cos\alpha$ $SQ = \frac{1}{\cos\alpha} \times \frac{6}{\cos\theta}$ $SQ = \frac{6}{\cos\theta\cos\alpha}$	✓ $\hat{QPR}$ ✓ sine rule / *sinusreël* ✓ correct substitution *korrekte vervanging* ✓ reduction/*reduksie* ✓ identity/*identiteit* ✓ simplification/*vereenvoudiging* $\frac{PQ}{SQ}$	(6)
8.2	$SQ = \frac{6}{\cos 50^0 \cos 35^0}$ $= 11{,}40$	✓ correct substitution/ *korrekte vervanging* ✓ answer/*antwoord*	(2)
			[8]

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QUESTION/*VRAAG 9*

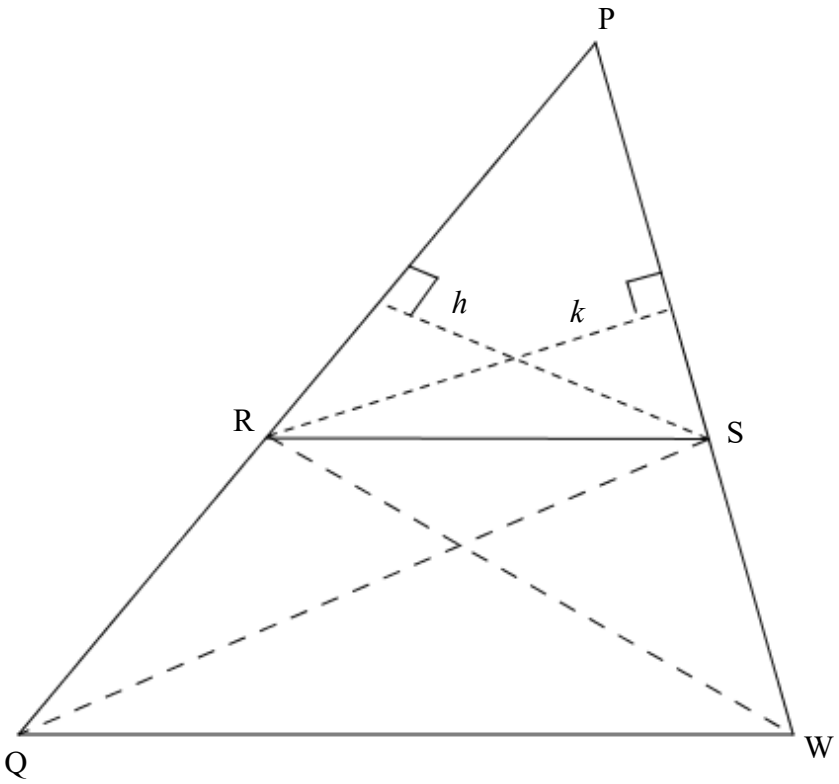
9.1	Opposite interior angle ✓	(1)



9.2.1	$\hat{A}_2 = 21^0$	[ext.∠ of a cyclic quad]/[*buite ∠ van koordevh*]	✓ S ✓R (2)
9.2.2	$D_2 = 21^0$	[∠s same seg]/[*∠e in dieselfde segment*]	✓ S ✓R (2)
9.2.3	$\hat{D} = 75^0$ $\hat{A}_1 = 54^0$	[corresp. ∠s; AD||BC] / [*ooreenk.∠e: AD || BC*] [Tan chord Thm.] / [*Raaklyn – koord – Stelling*]	✓ S/R ✓ S ✓R (3)
9.2.4	$\hat{A}_3 = \hat{C}_2 = 54^0$ $\hat{C}_2 = \hat{D}_1$ $\therefore AE = ED$	[alt. ∠s, AD || BC] [*∠s same seg*] [*sides opp = ∠s*]	✓S/R ✓ S ✓R (3)
			[11]

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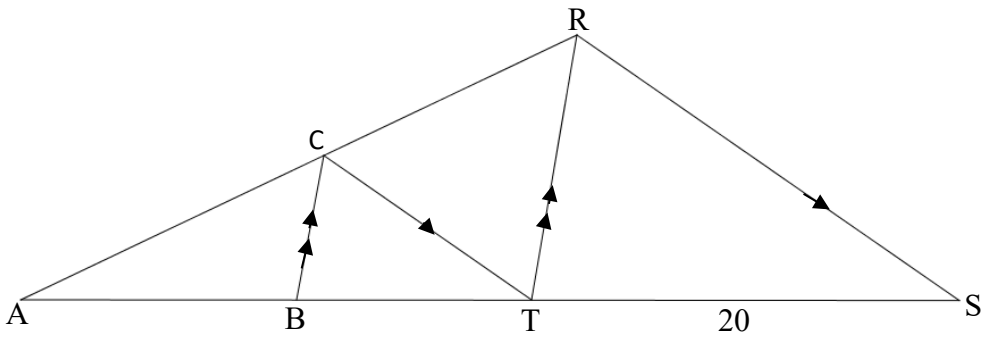
QUESTION/*VRAAG 10*



10.1	Constructions: Draw $\perp$ height to PS and $\perp$ height to PW. Join RW and SQ *Konstruksies: Teken $\perp$ hoogte na PS en $\perp$ hoogte na PW. Verbind RW en SQ*	✓ construction *konstruksie*	
	$\frac{\text{Area of/}van\ \Delta PRS}{\text{Area of/}van\ \Delta WRS} = \frac{\frac{1}{2}\times PS\times h}{\frac{1}{2}\times SW\times h} = \frac{PS}{SW}$ [*same height*] / [*dieselfde hoogte*]	✓ S/R	
	$\frac{\text{Area of/}van\ \Delta PRS}{\text{Area of/}van\ \Delta QRS} = \frac{\frac{1}{2}\times PR\times k}{\frac{1}{2}\times RQ\times k} = \frac{PR}{RQ}$ [*same height*] / [*dieselfde hoogte*]	✓ S	
	$\text{Area of/}van\ \Delta RSW = \text{Area of/}van\ \Delta QRS$ [*same base, betwen same parallel*] [*dies. basis, tussen dies. $\parallel$ lyne*]	✓ S ✓ R	
	$\frac{\text{Area of/}van\ \Delta PRS}{\text{Area of/}van\ \Delta WRS} = \frac{\text{Area of/}van\ \Delta PRS}{\text{Area of/}van\ \Delta QRS}$ $\therefore \frac{PS}{SW} = \frac{PR}{RQ}$		(5)

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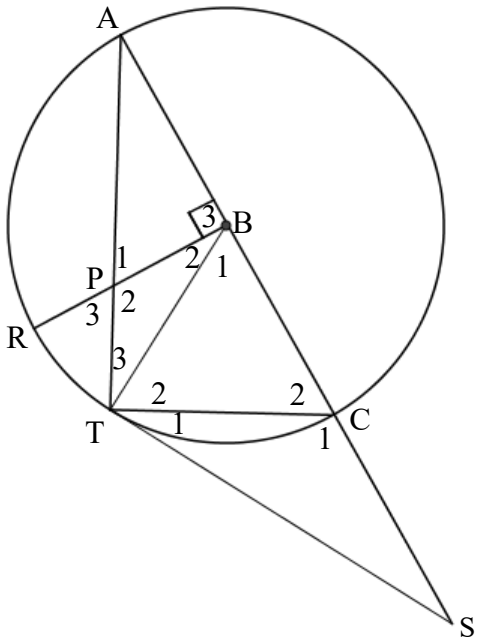
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10.2			
10.2.1	$\frac{AT}{TS}=\frac{AC}{CR}$ $[line\|\|to\ one\ side\ of\ a\ \Delta]/[lyn\ \|\|\ aan\ een\ sy\ van'n\ \Delta]$ $AT=\frac{20\times 3}{5}$ $=12$	✓ S ✓ R ✓ correct substitution *korrekte vervanging* ✓ AT	(4)
10.2.2	$\frac{AB}{AT}=\frac{AC}{AR}$ $[line\|\|to\ one\ side\ of\ a\ \Delta]$ $\frac{AB}{20}=\frac{5}{8}$ $AB=\frac{9}{2}$	✓ S ✓ correct substitution *korrekte vervanging* ✓ AB	(3)
			[12]

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QUESTION/*VRAAG 11*



11.1	$\hat{T}_1 = \hat{A}$ [tan chord theo.]/[*raaklyn – koord – stelling*] $\hat{A} = \hat{T}_3$ [∠s opp.=sides]/[*∠e teenoor=sye*]	✓S ✓R ✓ S/R	(3)
11.2	$A\hat{T}C = 90^0$ [∠in semi-circle / ∠subt.diameter] [*∠in halwe sirkel / ∠onderspan deur middellyn*] $\hat{B}_3 = 90^0$ [given]/[*gegee*] ∴ PBTC is a cyclic quad [ext ∠ of a quad = int opp.∠ OR converse ext ∠ of a cyclic quad] ∴ *PBTC is 'n koordevh.* [*buite ∠ van 'n koordevh = teenoorst.binne ∠ OF omgek ker de buite ∠ van koordevh*]	✓ S ✓R ✓ R	(3)
11.3	$\hat{T}_1 = \hat{T}_3$ [proven in 11.1]/[*bewys in* 11.1] $\hat{C}_1 = \hat{P}_2$ [ext.∠ of a cyclic quad]/[*buitehoek van kv*] $\hat{S} = \hat{B}_2$ [3rd ∠s / ∠e] **OR/*OF*** ∴ ΔSCT ||| ΔBPT [∠∠∠]	✓ S ✓ S ✓ R ✓ S **OR/*OF*** ✓ R	(4)

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11.4	$\frac{SC}{BP}=\frac{ST}{BT}$ $[\|\|\|\Delta s]$ $BT = AB$ [radii]/ [*radiusse*] $\therefore SC=\frac{ST.BP}{AB}$	✓S/R ✓S	(2)
11.5	$B\hat{T}S = 90^0$ [*rad* ⊥ tan]/ [*radius* ⊥ *raaklyn*]	✓ R	(1)
11.6	$TB = CS$ [both = BR]/[*albei = BR*] $BS^2 = BT^2 + TS^2$ [Pyth theo]/[*Pyth Stelling*] $(2CS)^2 = CS^2 + TS^2$ $4CS^2 = CS^2 + TS^2$ $3CS^2 = TS$ (1) but / *maar* $CS=\frac{TS.BP}{AB}$ from 11.4 $CS = AB = BR$ $CS^2 = TS.BP$ (2) $TS^2 = 3(TS.BP)$ $\therefore TS = 3BP$	✓ Application of Pyth. Toepassing van Pyth. ✓ Expressing BS in terms of CS BS *in terme van* CS *uitgedruk* ✓ simplification / *vereenvoudiging* ✓ $CS^2 = ST.BP$ ✓ substitute/*vervang* (2) in (1)	(5)
			[18]

TOTAL/*TOTAAL*: 150

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Department of Education
FREE STATE PROVINCE

PREPARATORY EXAMINATION/
VOORBEREIDENDE EKSAMEN

GRADE/*GRAAD* 12

MATHEMATICS P2/
WISKUNDE V2

SEPTEMBER 2026

MARKS/*PUNTE*: 150

MARKING GUIDELINES/
NASIENRIGLYNE

These marking guidelines consist of 20 pages./
Hierdie nasienriglyne bestaan uit 20 bladsye.

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Please turn over/*Blaai om asseblief*

NOTE:

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- If a candidate has crossed out an attempt at a question and not redone the question, mark the crossed-out version.
- Consistent accuracy applies in ALL aspects of the marking memorandum. Stop marking the second calculation error.
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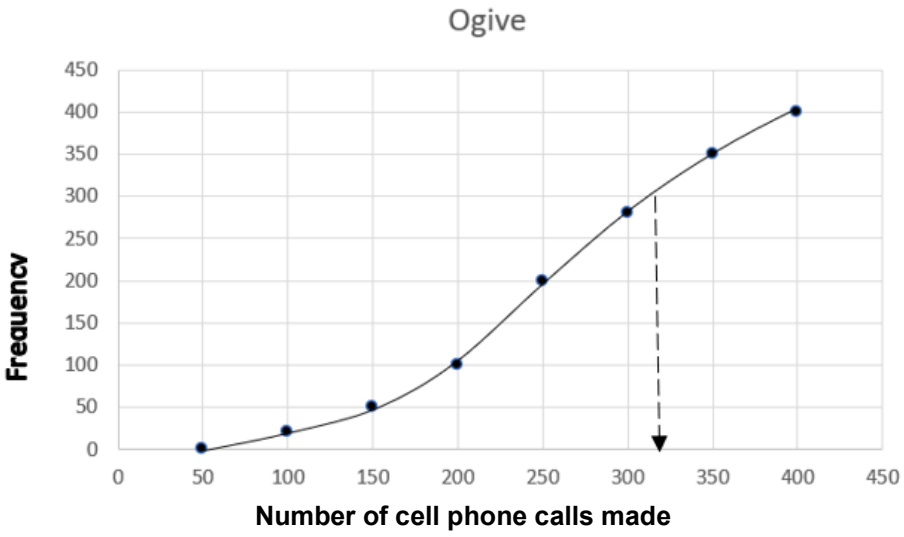
NOTA:

- *As 'n kandidaat 'n vraag TWEE KEER beantwoord, merk slegs die EERSTE poging.*
- *As 'n kandidaat 'n antwoord van 'n vraag doodtrek en nie oordoen nie, merk die doodgetrekte poging.*
- *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.*

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QUESTION/*VRAAG* 1

Cell phone call made	Frequency
$50 \le x < 100$	20
$100 \le x < 150$	30
$150 \le x < 200$	Q
$200 \le x < 250$	R
$250 \le x < 300$	80
$300 \le x < 350$	70
$350 \le x < 400$	50



1.1	A = 50	✓answer (1)
1.2	400	✓answer (1)
1.3	Q = 50 and R = 100	✓ Q = 50 ✓ R = 100 (2)
1.4	Q_3 = greater than 300 and less than 325 Q_1 = 200 IQR =110 (CA based on values)	✓ Q_3 value ✓ Q_1 value ✓ answer (3)
1.5	Mean = 250	✓ answer (2)
1.6.1	It would decrease. People will leave the contract. Therefore, fewer people.	✓ answer ✓ explanation (2)
1.6.2	Standard deviation would decrease. The difference between the new mean and the data would decrease.	✓ answer ✓ explanation (2)
1.6.3	It would skew the data to the left. The values above the median are less spread out. **OR**	✓ answer ✓ explanation (2) **OR**

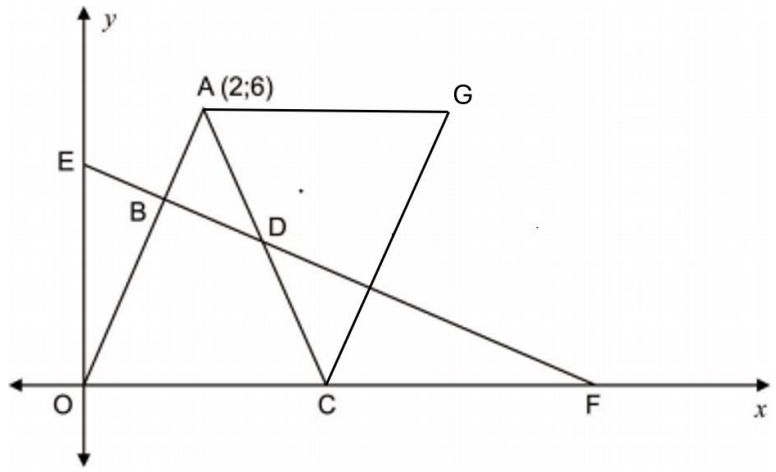
	It would skew the data to the left. Mean < median	✓ answer ✓ explanation (2)
		[15]

QUESTION/*VRAAG* 2

Rest days given	5	2	9	1	3	12	10	4	4	5	8	6
Performance of the player	0,87	0,65	0,9	0,58	0,7	0,91	0,88	0,78	0,72	0,91	0,82	0,62

2.1	0,7337≈ 0,73	✓✓answer	(2)
2.2	C	✓answer	(1)
2.3	A = 0,6268 ≈0,63 B = 0,0264 ≈0,03	✓ value of A ✓ value of B	(2)
2.4	No. 30 falls outside the given data; therefore it will not be accurate. Extrapolation will be taking place.	✓ answer ✓ reason	(2)
			[7]

QUESTION/*VRAAG* 3

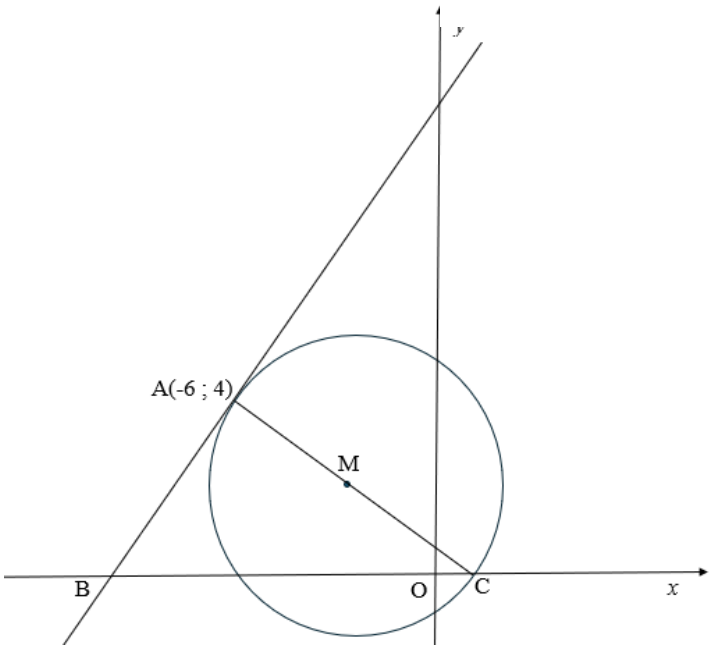


3.1	$OA = \sqrt{(0-2)^2 + (0-6)^2}$ $= \sqrt{40}$ $= 2\sqrt{10}$ $= 6{,}32$ $OA = AC = 6{,}32$	✓substitution ✓ answer ✓ OA = AC (3)
3.2	Midpoint M $\left(\frac{0+2}{2};\frac{0+6}{2}\right)$ $= (1;3)$ Answer only full marks	✓ x - value ✓ y - value (2)
3.3	Using translation G (6 ; 6) Answer only full marks	✓ x -value ✓ y - value (2)
3.4	$m_{OA} = 3$ Equation of line OA is $y = 3x$ Eqauation of line EF is $2y + x = 10$ $2(3x) + x = 10$ $7x = 10$ $x = \frac{10}{7}$ (this represents the height of the triangle) $B\left(\frac{10}{7} : \frac{30}{7}\right)$	✓ gradient of OA ✓ equation of OA ✓equating ✓ value of x ✓ value of y (5)

3.5	Coordinates of E $2y + 0 = 10$ $y = 5$ $E(0;5)$ Area of $\Delta EBO = \frac{1}{2} \times 5 \times \frac{10}{7}$ $= \frac{25}{7}$ $= 3{,}57\ units^2$ **OR** Inclination of OA : $\tan\theta = 3$ $\theta = 71{,}57°$ $E\hat{O}B = 18{,}43°$ OB = 4.52 units Area of $\Delta EBO = \frac{1}{2} OE.OB\ \sin E\hat{O}B$ $= \frac{1}{2}(4{,}52)(5)\sin 18{,}43°$ $= 3{,}57 units^2$	✓value of y ✓ substitution ✓answer (3) ✓angle EOB ✓substitution ✓answer (3)
3.6	C(4 ; 0) $2(0) + x = 10$ $x = 10$ CF = 6 Area $\Delta DFC = \frac{1}{2} \times 6 \times \frac{18}{5}$ $= \frac{54}{5}$ $= 10{,}80\ units^2$ **OR** C(4 ; 0) $2(0) + x = 10$ $x = 10$ CF = 6 $2y + x = 10\ sub\ y = \frac{18}{5}$ $2\left(\frac{18}{5}\right) + x = 10$ $x = \frac{14}{5}$ $D\left(\frac{14}{5}; \frac{18}{5}\right)$ $C(4;0)$	✓ coordinates of C ✓ length CF ✓substitution ✓ answer (4) ✓ length CF

	$DC = \sqrt{\left(4-\frac{14}{5}\right)^2+\left(0-\frac{18}{5}\right)^2}$ $= \sqrt{\frac{360}{25}}$ $= 3{,}79$ $m_{DC} = \frac{0-\frac{18}{5}}{4-\frac{14}{5}}$ $= -3$ $\tan\theta = -3$ $\text{Ref angle} = 71{,}57°$ $\theta = 108{,}43°$ $Area\ \Delta DFC = \frac{1}{2}DC.CF\ sin\ D\hat{C}F$ $= \frac{1}{2}(3{,}79).(6)\ sin\ 108{,}43°$ $= 10{,}79\ \ units^2$	✓ length of DC ✓substituting DC,CF and sin108,43° ✓ answer (4)
		[19]

QUESTION/*VRAAG* 4

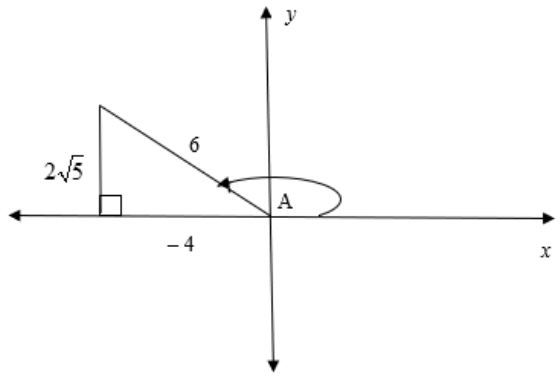


4.1.1	$x^2 + y^2 + 4x - 4y - 12 = 0$ $(x+2)^2 + (y-2)^2 = 12 + 4 + 4 = 20$ $\text{M}(-2;\ 2)$ **OR** $\text{M}\left(\frac{4}{-2};\frac{-4}{-2}\right)$ $\text{M}(-2;2)$	✓x value ✓y value (2) **OR** ✓x value ✓y value (2)
4.1.2	$x^2 + 0^2 + 4x - 4(0) - 12 = 0$ $x^2 + 4x - 12 = 0$ $(x+6)(x-2) = 0$ $x = -6 \ \ or\ x = 2$ $\text{C}(2;0)$ **OR** $\frac{x-6}{2} = -2$ $x = 2$ $\text{C}(2;0)$	✓ substitute $y = 0$ ✓ factors ✓ correct x value (3) **OR** ✓ correct use of formula ✓ x- value ✓ $y = 0$ (3)

4.2	M$(-2;2)$ C$(2;0)$ $m_{MC} = \frac{0-2}{2-(-2)}$ $m_{MC} = \frac{-1}{2}$ $m_{tan} = 2$ tangent $\perp$ radius $y-4=2(x-(-6))$ $y = 2x+16$	✓substitution ✓ gradient of tangent ✓ substituting A$(-6\ ;\ 4)$ ✓ equation (4)
4.3	$x^2+y^2+4x-4y-12=0$ $(x+2)^2+(y-2)^2 = 20$ $Centre\ O_1(-2;2)$ $radius_1 = \sqrt{20}$ $= 2\sqrt{5}$ $(x+4)^2+(y+2)^2=5$ $Centre\ O_2(-4;-2)$ $radius_2 = \sqrt{5}$ Distance between centres: $= \sqrt{(-4+2)^2+(-2-2)^2}$ $= \sqrt{4+16}$ $= \sqrt{20}$ $= 2\sqrt{5}$ $r_1 + r_2 = 3\sqrt{5}$ $3\sqrt{5} > 2\sqrt{5}$ therefore circles intersect	✓ $2\sqrt{5}$ ✓ *centre* $O_2\ (-4;-2)$ ✓distance between centres= $2\sqrt{5}$ ✓ $r_1 + r_2 = 3\sqrt{5}$ ✓ $3\sqrt{5} > 2\sqrt{5}$ (5)

4.4	Equation of tangent parallel to AB through C: $y-0=2(x-2)$ $y=2x-4$ $\therefore\ -4<k<16$ **OR** $x^2+(2x+k)^2+4x-4(2x+k)-12=0$ $5x^2+4xk-4x+k^2-4k-12=0$ $5x^2+(4k-4)x+(k^2-4k-12)=0$ $\Delta>0$ $(4k-4)^2-4(5)(k^2-4k-12)>0$ $16k^2-32k+16-20k^2+80k+240>0$ $-4k^2+48k+256>0$ $k^2-12k-64<0$ $(k+4)(k-16)<0$ $-4<k<16$	✓ $m=2$ ✓substitution ✓simplification ✓✓ answer (5) **OR** ✓substitution ✓standard form ✓ $(4k-4)^2-4(5)(k^2-4k-12)>0$ ✓✓ answer (5)
		[19]

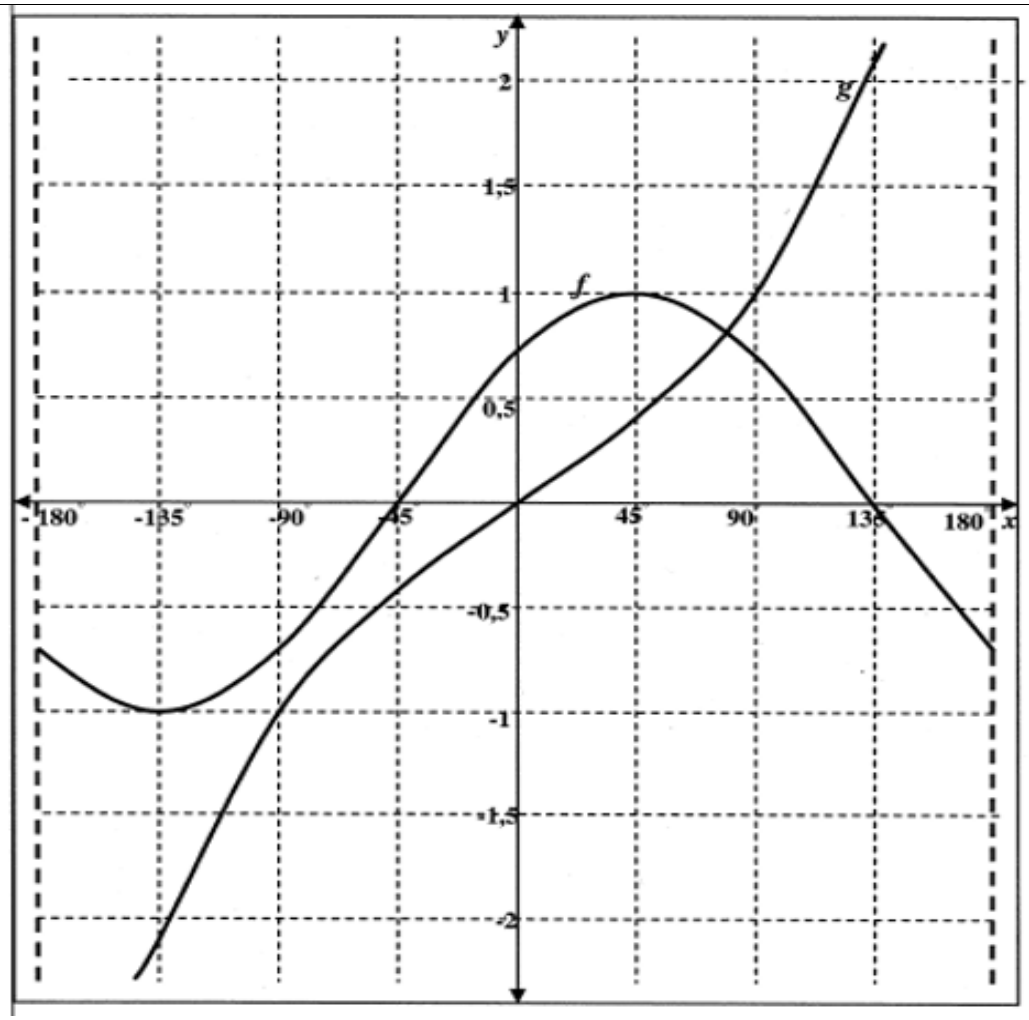
QUESTION/*VRAAG* 5

5.1.1	 $x^2 = (6)^2 - (\sqrt{20})^2$ $= 36 - 20$ $= 16$ $x = \pm 4$ only $x = -4$ $\sin 2A$ $= 2\sin A\cos A$ $= 2.\frac{2\sqrt{5}}{6}.\frac{-4}{6}$ $= \frac{-4\sqrt{5}}{9}$	✓ correct quadrant ✓ correct x-value ✓ double angle formulae ✓ substitution ✓ answer (5)
5.1.2	$\cos 2\left(\frac{A}{2}\right) = 1 - 2\sin^2\left(\frac{A}{2}\right)$ $2\sin^2\left(\frac{A}{2}\right) = 1 - \cos A$ $\sin\left(\frac{A}{2}\right) = \sqrt{\frac{1 - \frac{-4}{6}}{2}}$ $= \sqrt{\frac{5}{6}}$	✓reduction formulae ✓ substitution ✓ answer (3)

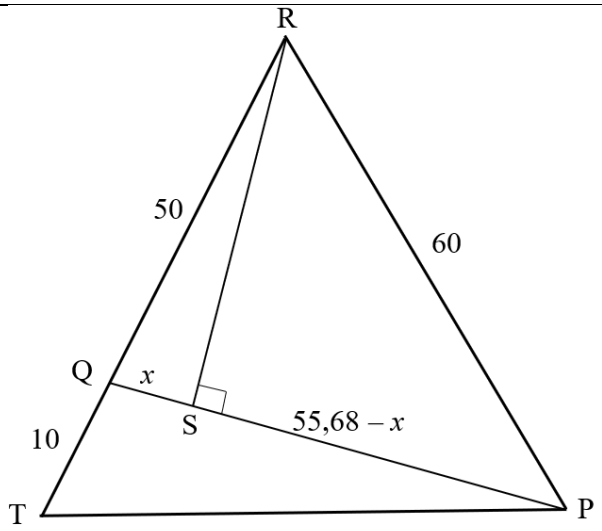
5.2	$\frac{\sin x.\sin(90°+y)-\cos x.\sin(180°+y)}{\cos x.\cos(y-360°)+\sin(-x).\sin y}$ $=\frac{\sin x.(\cos y)-\cos x.(-\sin y)}{\cos x.(\cos y)+(-\sin x)\sin y}$ $=\frac{\sin x.\cos y+\cos x.\sin y}{\cos x.\cos y-\sin x.\sin y}$ $=\frac{\sin(x+y)}{\cos(x+y)}$ $=\tan(x+y)$	✓$\cos y$ ✓$-\sin y$ ✓$\cos y$ ✓ $-\sin x$ ✓ $\frac{\sin(x+y)}{\cos(x+y)}$ ✓ $\tan(x+y)$ (6)
5.3	LHS : $\frac{\sin\theta}{\cos\theta}+\frac{\cos\theta}{\sin\theta}$ $=\frac{\sin^2\theta+\cos^2\theta}{\cos\theta.\sin\theta}$ $=\frac{1}{\cos\theta.\sin\theta}$ RHS: $\frac{2}{\sin 2\theta}$ $=\frac{2}{2\sin\theta.\cos\theta}$ $=\frac{1}{\sin\theta.\cos\theta}$ LHS = RHS	✓ $\frac{\sin\theta}{\cos\theta}$ ✓simplification ✓ $\sin^2\theta + \cos^2\theta$ ✓ double angle ✓simplification (5)
5.4.1	$-1 \le m \le 1$ **OR** $m \in [-1; 1]$	✓✓ answer (2) **OR** ✓✓ answer (2)

5.4.2	$3\sin\theta - \frac{4}{\sin\theta} + 4 = 0$ $3\sin^2\theta - 4 + 4\sin\theta = 0$ $3\sin^2\theta + 4\sin\theta - 4 = 0$ $(3\sin\theta - 2)(\sin\theta + 2) = 0$ $\sin\theta = \frac{2}{3}$ or $\sin\theta = -2$ ref angle = $41{,}81°$ $\theta = 41{,}81 + k360°, k \in Z$ OR $\theta = 180° - 41{,}81° + k360°;\ k \in Z$ $\theta = 138{,}19° + k360°, k \in Z$ $\theta = 41{,}81°$ or $138,19^\circ$ $\theta \in [-180°;180°]$	✓ standard form ✓ factors ✓ $x = 41{,}81 + k360°$ ✓ $x = 138{,}19° + k360°, k \in Z$ ✓ $x = 41{,}81°$ or ✓ $x = 138,19^\circ$ (6)
5.5	$AB^2 = (\cos\theta - 6)^2 + (\sin\theta - 7)^2$ $86 = \cos^2\theta - 12\cos\theta + 36 + \sin^2\theta - 14\sin\theta + 49$ $86 = 1 + 36 + 49 - 12\cos\theta - 14\sin\theta$ $0 = -12\cos\theta - 14\sin\theta$ $14\sin\theta = -12\cos\theta$ $\frac{\sin\theta}{\cos\theta} = \frac{-12}{14}$ $\tan\theta = \frac{-6}{7}$ $= -0{,}86$	✓ substitution ✓ simplification ✓ $14\sin\theta = -12\cos\theta$ ✓ answer (4)
		[31]

QUESTION/*VRAAG* 6

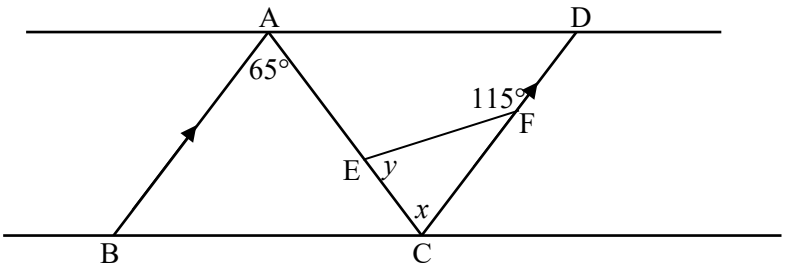
6.1	 *f :* ✓*x*- intercepts/*afsnitte* ✓ *y*-intercepts/*afsnitte* ✓ turning points/ *draaipunte* *g :* ✓ asymptotes/*asimptote* ✓✓passing through/*gaan deur* (0 ; 0), (-90°;-1),(90°;1)	(6)
6.2.1	$x = -45°$ *or / of* $x = 135°$	✓ $x = -45°$ ✓ $x = 135°$ (2)
6.2.2	$x = 180°$ *or / of* $x = -180°$	✓ $x = 180°$ ✓ $x = -180°$ (2)
6.2.3	1	✓answer/*antwoord* (1)
6.2.4	$x \in (-180°; -45°)$ *or / of* $x \in (0°; 135°)$ **OR** $-180° < x < -45°$ *or / of* $0 < x < 135°$	✓ $-180°$; -45° ✓0° ; 135° ✓notation/*notasie* (3)
		[14]

QUESTION/*VRAAG* 7

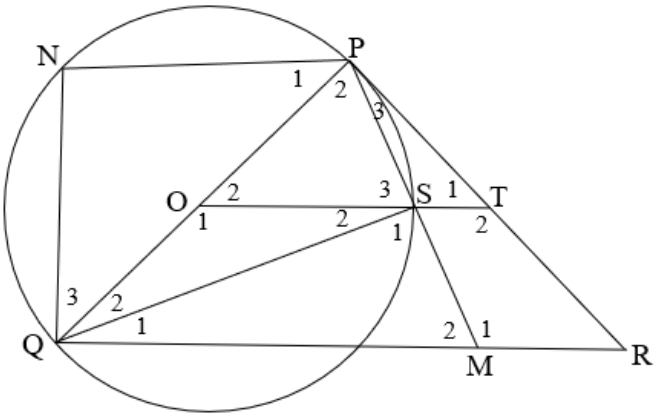
7.1	$\hat{R} = \hat{T} = \hat{P} = 60°$ $QT = 10$ and/ *en* $QR = 50$ $PQ^2 = 60^2 + 50^2 - 2(50)(60)\cos 60°$ $= 3100$ $PQ = 55{,}68\ units$ OR $PQ^2 = 60^2 + 10^2 - 2(10)(60)\cos 60°$ $= 3100$ $PQ = 55{,}68\ units$	✓ 60° ✓ 10 or/*of* 50 ✓ correct substitution into the cosine rule/ *korrekte vervanging in cosreël* ✓answer/a*ntwoord* (4) **OR** ✓ 60° ✓ 10 or/*of* 60 ✓ correct substitution into the cosine rule/ *korrekte vervanging in cosreël* ✓answer/*antwoord* (4)
7.2	 S is the nearest to R where RS is the perpendicular height/ *S is die naaste aan R waar RS die loodregte hoogte is* Let/ Laat QS = x $\therefore$ PS = $55{,}68 - x$ $(50^2 - x^2) = (60^2 - [55.68 - x]^2 = RS^2$ $2500 - x^2 = 3600 - 3100{,}26 + 11136x - x^2$ $2000{,}26 = 11136x$ $\therefore\ x = 17{,}96$ *units / eenhede*	✓ diagram/*diagram* ✓Pythagoras/*Pythagoras* ✓simplify/*vereenvoudig* ✓answer/a*ntwoord* (4)
		[8]

GEOMETRY/*MEETKUNDE*

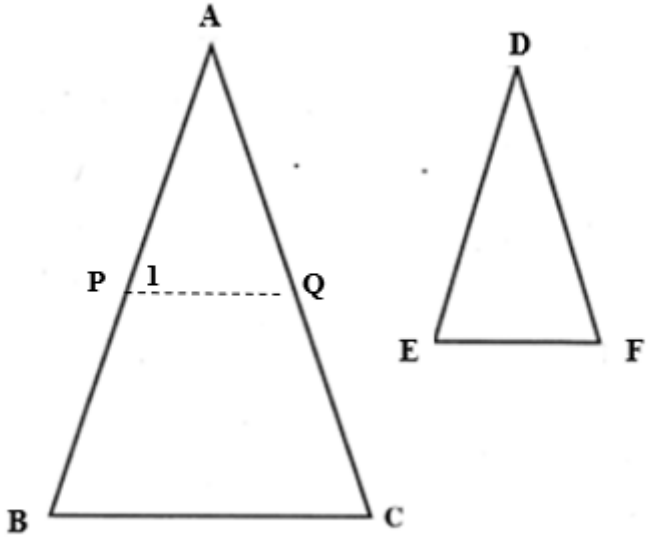
Please read carefully through the following table before marking **QUESTION 8–9**/
*Lees asseblief sorgvuldig deur die volgende tabel alvorens **VRAAG 8–9** nagesien word.*

	The order in which the candidate answers a geometry question must follow logically/*Die volgorde waarin 'n kandidaat 'n meetkundevraag beantwoord moet logies volg.* **Example/*Voorbeeld*** Given/*Gegee* AB ‖ CD and/*en* $E\hat{F}D = 115°$  The candidate first needs to calculate *x* BEFORE he/she can calculate *y/Die kandidaat moet eerste vir x bereken VOORDAT hy/sy vir y kan bereken.*
S	A mark for a correct statement (A statement mark 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 the statement AND reason are both correct (Both MUST be correct to get one mark)
	Ken 'n punt toe as die bewering EN rede beide korrek is *(Beide MOET korrek wees om een punt te kry)*

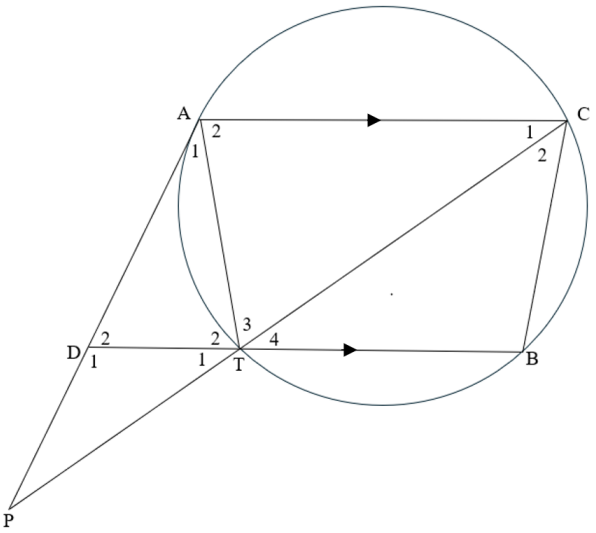
QUESTION/*VRAAG* 8

8.1.1	90°	✓ answer/ *antwoord* (1)
8.1.2	parallel ...equal to half the length of the third side *parallel....gelyk aan die helfte van dielengte van die derde sy.*	✓ answer/ *antwoord* (2)
8.2		
8.2.1	$Q\widehat{P}R = 80°$ sum of interior angles of triangle/*som van binne hoeke van 'n driehoek*	✓S ✓R (2)
8.2.2	OT//QR midpoint theorem/*middelpunt stelling* $P\widehat{T}O = \widehat{R} = 25°$ corres angles OT//QR/*ooreenk hoeke* OT//QR	✓S/R ✓ S/R (2)
8.2.3	$Q\widehat{N}P = 90°$ angles in a semi-circle/*hoeke in 'n halfsirkel*	✓S ✓R (2)
8.2.4	$\widehat{S}_2 + \widehat{S}_3 = 90°$ opposite angles of a cyclic quad/*teenoorstaande hoeke van koordevierhoek* $\widehat{S}_1 = 90°$ angles on a str. line/*hoeke op 'n reguitlyn*	✓S/R ✓ S/R (2)
8.3	OS//QR OT//QR proved in 8.2.2/OT//QR *bewys in* 8.2.2 PS = SM converse of midpoint theorem/*omgekeerde van middelpunt stelling*	✓S/R ✓S/R (2)
8.4	In ΔPOS and ΔMQS $\widehat{S}_2 + \widehat{S}_3 = \widehat{S}_1 = 90°$ proved/*bewys* QS = QS common/*gemeenskaplik* PS = SM proved/*bewys* ΔPQS = ΔMQS [SAS]/[SHS]	✓S ✓S/R ✓S ✓R (4)
8.5	PQ = QM ΔPQS ≡ Δ MQS 2PO = PQ radii/*radii* QM=2PO	✓S/R ✓S/R (2)
		[19]

QUESTION/*VRAAG 9*



9.1	Construction/*Konstruksie* On AB mark off AP=DE and on AC mark off AQ= DF/*Op AB merk af AP = DE en op AC merk af AQ = DF* Proof/*Bewys:* In ΔAPQ and ΔDEF AP = DE const/*konst* AQ = DF const/*konst* $\hat{A} = \hat{D}$ given/*gegee* ΔAPQ ≡ ΔDEFSAS/*SHS* $\hat{P_1} = \hat{E}$ But $\hat{E} = \hat{B}$ $\hat{P_1} = \hat{B}$ PQ//BC corres ∠'s/*ooreenkom ∠'e* $\frac{AB}{AP} = \frac{AC}{AQ}$ line//tooneside of Δ/*lyn//aaneen sy van Δ* $\frac{AB}{DE} = \frac{AC}{DF}$ AP = DE and AQ = DP	✓Construction/*Konstruksie* ✓ ΔAPQ ≡ ΔDEF SAS/*SHS* ✓$\hat{P}_1 = \hat{E}$ ✓$\hat{E} = \hat{B}$ ✓$\hat{P}_1 = \hat{B}$ ✓ PQ // BC ✓ S/R (7)

9.2		
9.2.1	In ΔPAT and ΔPCA $\hat{P} = \hat{P}$ common/*gemeenskaplik* $\widehat{A_1} = \widehat{C_1}$ tan chord theorem/tan *koordstelling* $P\hat{T}A = P\hat{A}C$ sum of int ∠'s */som van binne hoeke van Δ* ΔPAT///ΔPCA ∠∠∠ $\therefore \frac{PA}{PC} = \frac{PT}{PA}$ *///Δ's* $PA^2 = PC.PT$	✓ S identifying Δ's /*identifiseer* Δ'e ✓ S ✓ S/R ✓ S/R ✓ S (5)
9.2.2	$PA^2 = PC.PT$ $36 = (x+5)x$ $x^2 + 5x - 36 = 0$	✓ substitution/*substitusie* ✓ simpliy/*vereenvoudig* (2)
9.2.3	$(x+9)(x-4) = 0$ $x = -9$ *or* $x = 4$ PT = 4	✓ factorise/*faktoriseer* ✓ answer/*antwoord* (2)
9.2.4	$\frac{PD}{PA} = \frac{PT}{PC}$ prop theorem AC // DB *eweredigheidstelling* AC // DB $DP = \frac{4}{9}.6$ $= \frac{8}{3}$	✓S/R ✓ answer/*antwoord* (2)
		[18]

TOTAL/*TOTAAL*: 150

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GAUTENG PROVINCE
EDUCATION
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PREPARATORY EXAMINATION

2026

MARKING GUIDELINES

MATHEMATICS PAPER 2 (10612)

23 pages

INSTRUCTIONS AND INFORMATION

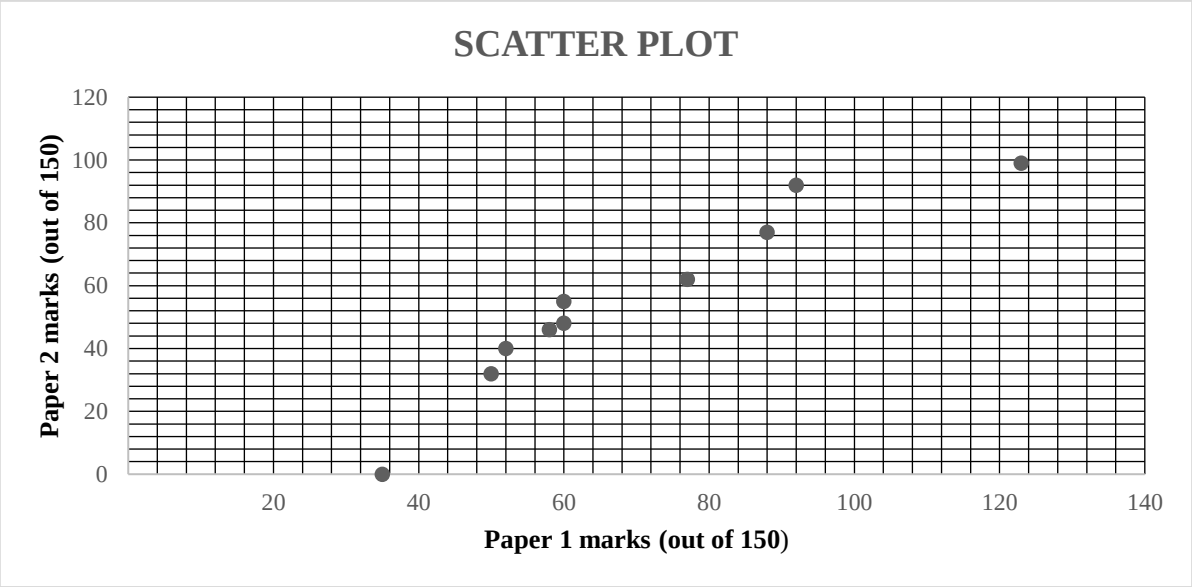
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GEOMETRY	
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R	A mark for a correct reason (A reason mark may only be awarded if the statement is correct.)
S/R	Award a mark if the statement AND reason are both correct.

QUESTION 1

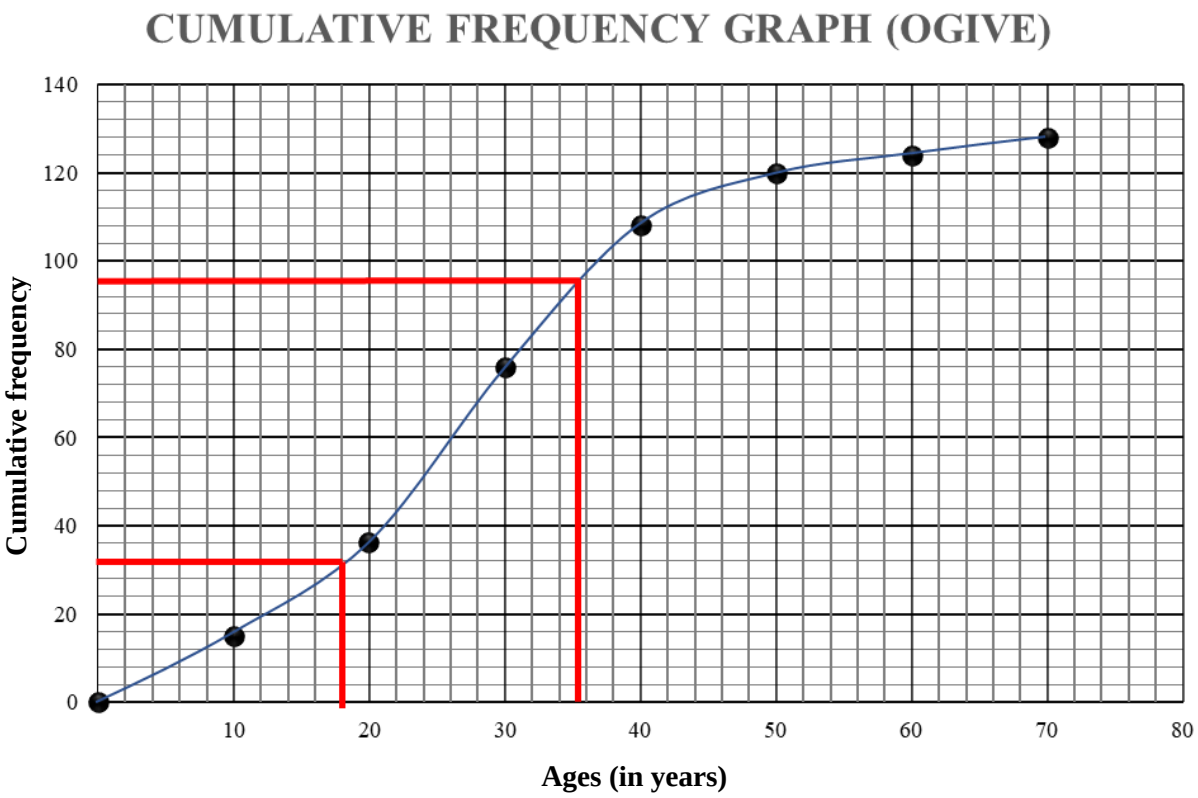
Paper 1 (out of 150 marks)	35	50	52	58	60	60	77	88	92	123
Paper 2 (out of 150 marks)	0	32	40	46	48	55	62	77	92	99



	SOLUTIONS	**MARK DESCRIPTIONS**	**MARKS**
1.1	$a = -19{,}86$ $b = 1{,}08$ $\therefore y = -19{,}86 + 1{,}08x$ **Answer Only Full marks**	✓ $a = -19{,}86$ ✓ $b = 1{,}08$ ✓ equation	(3)
1.2	$r = 0{,}95$	✓ $r = 0{,}95$	(1)
1.3	Strong positive correlation	✓ answer	(1)
1.4	$y = -19{,}86 + 1{,}08\ (75)$ $y = 61{,}14$ **OR** $y = 61{,}03$ (calculator) **Answer Only Full marks**	✓ substitution ✓ answer **OR** ✓✓answer	(2) (2)
1.5	$\sigma = 27{,}83$	✓ answer	(1)
1.6.1	$\bar{x} = 69{,}5 + 4$ $\therefore \bar{x} = 73{,}5$	✓ answer	(1)
1.6.2	The **standard deviation will remain the same** as all data changed with the same value.	✓ answer	(1)
1.7	He ranked higher in paper 2. 52 is the first quartile for paper 1 and 51 is the median for paper 2, He ranked higher in paper 2. **OR** Using the given table, he ranked 8th in paper 1 and 6th in paper 2.	✓ answer ✓ explanation	(2)

[12]

QUESTION 2

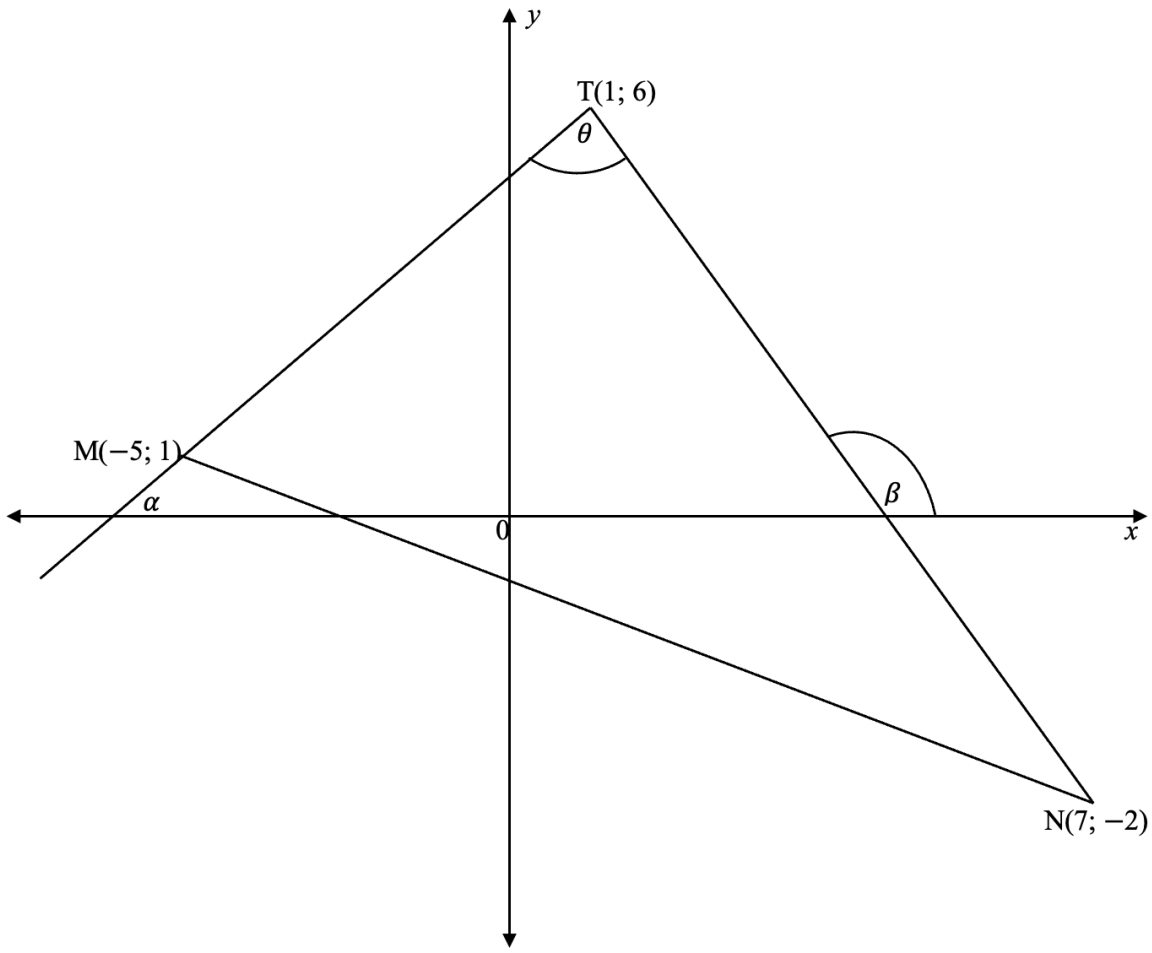


	SOLUTIONS	MARK DESCRIPTIONS	MARKS
2.1	**Age groups:** / **Number of T-shirts Sold:** $0 < x \leq 10$: 15 $10 < x \leq 20$: 21 $20 < x \leq 30$: 40 $30 < x \leq 40$: 32 $40 < x \leq 50$: 12 $50 < x \leq 60$: 4 $60 < x \leq 70$: 4	✓ 21; 40; 32 ✓ 12; 4; 4	(2)

2.2	$20 < x \leq 30$	✓ answer	(1)
2.3	$Q_1 = 18 \quad Q_3 = 35$ (Accept 36) $\therefore$ IQR $= 35 - 18$ $= 17$ (Accept 18)	✓ 18 ✓ 35 ✓ answer	(3)
2.4	Cumulative graph will become steeper. **OR** The last two points will be higher.	✓ ✓ correct reason	(2)

[8]

QUESTION 3



	SOLUTIONS	MARK DESCRIPTIONS	MARKS
3.1	$\text{MT} = \sqrt{(1+5)^2 + (6-1)^2}$ $\therefore \text{MT} = \sqrt{61}$ = 7,81 units	✓ substitution ✓ answer	(2)
3.2	$m_{\text{TN}} = \frac{6+2}{1-7}$ $\therefore m_{\text{TN}} = -\frac{4}{3}$	✓ substitution ✓ answer	(2)

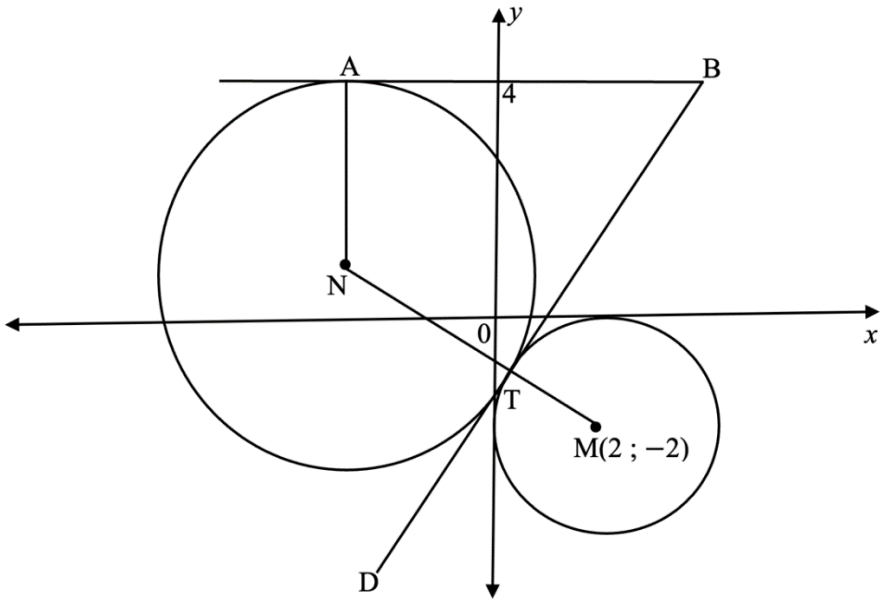
3.3	$y = -\frac{4}{3}x + c$ subs point T(1; 6) $6 = -\frac{4}{3}(1) + c$ $\therefore c = \frac{22}{3}$ **OR** $y - y_1 = -\frac{4}{3}(x - x_1)$ $y - 6 = -\frac{4}{3}(x - 1)$ $y - 6 = -\frac{4}{3}x + \frac{4}{3}$ $\therefore y = -\frac{4}{3}x + \frac{22}{3}$	✓ substitution of gradient and point T(1 ; 6) ✓ answer **OR**	(2)
	$y = -\frac{4}{3}x + c$ subs point N(7 ; −2) $-2 = -\frac{4}{3}(7) + c$ $\therefore c = \frac{22}{3}$ **OR** $y - y_1 = -\frac{4}{3}(x - x_1)$ $y - (-2) = -\frac{4}{3}(x - 7)$ $y + 2 = -\frac{4}{3}x + \frac{28}{3}$ $\therefore y = -\frac{4}{3}x + \frac{22}{3}$	✓ substitution of gradient and point N(7 ; −2) ✓ answer	(2)
3.4	$\tan\beta = -\frac{4}{3}$ $\therefore \beta = 126{,}87\,°$ $m_{TM} = \frac{6-1}{1+5}$ $\therefore m_{TM} = \frac{5}{6}$ $\tan\alpha = \frac{5}{6}$ $\therefore \alpha = 39{,}81°$ $\theta = 126{,}87° - 39{,}81°$ [ext ∠ of a Δ) $\therefore \theta = 87{,}06°$ **OR** $MN^2 = MT^2 + NT^2 - 2(MT)(NT)\cos\theta$ $153 = 61 + 100 - 2\left(\sqrt{61}\right)\left(\sqrt{100}\right)\cos\theta$ $-8 = 20\sqrt{61}\cos\theta$ $\cos\theta = \frac{-8}{20\sqrt{61}}$ $\theta = 87{,}06°$	✓ value of β ✓ $m_{TM} = \frac{5}{6}$ ✓ value of α ✓ answer **OR** ✓ correct use of cosine rule ✓ MN & NT ✓ simplification ✓ answer	(4) (4)

3.5	$m_{TN} \times m_{TP} = -1$ $\therefore m_{TP} = \frac{3}{4}$ $\frac{3}{4} = \frac{9-6}{r-1}$ $3r - 3 = 12$ $3r = 15$ $r = 5$ **OR**	✓ $m_{TP} = \frac{3}{4}$ ✓ correct substitution into gradient formula ✓ answer **OR**	(3)
	$m_{TP} = \frac{9-6}{r-1}$ $\therefore m_{TP} = \frac{3}{r-1}$ $m_{TN} \times m_{TP} = -1$ $\therefore \left(-\frac{4}{3}\right) \times \left(\frac{3}{r-1}\right) = -1$ $\frac{-12}{3r-3} = -1$ $-3r + 3 = -12$ $-3r = -15$ $\therefore r = 5$ **OR**	✓$m_{TP} = \frac{9-6}{r-1}$ ✓$\left(-\frac{4}{3}\right) \times \left(\frac{3}{r-1}\right) = -1$ ✓answer **OR**	(3)
	$m_{TN} = -\frac{4}{3}$ $m_{TN} \times m_{TP} = -1$ $\therefore m_{TP} = \frac{3}{4}$ $y - 6 = \frac{3}{4}(x - 1)$ $y = \frac{3}{4}x + \frac{21}{4}$ $(r\ ;\ 9)$ $9 = \frac{3}{4}r + \frac{21}{4}$ $\frac{3}{4}r = \frac{15}{4}$ $r = 5$	✓substituting *m* and point T ✓substitution of point P ✓ answer	(3)

3.6	$N\widehat{T}P = 90°$ [given] $\therefore$ PN is a diameter [conv $\angle$ in semi circle/ chord subtends 90°] P(5; 9) N(7; −2) $x = \frac{5+7}{2}$ $y = \frac{9-2}{2}$ $x = 6$ $y = \frac{7}{2}$ $\therefore$ Centre of the circle is $\left(6; \frac{7}{2}\right)$ PN $= \sqrt{(7-5)^2 + (-2-9)^2}$ $\therefore$ PN $= 5\sqrt{5}$ units $\therefore r = \frac{5\sqrt{5}}{2}$ units $\therefore r^2 = \frac{125}{4}$ $\therefore (x-6)^2 + \left(y - \frac{7}{2}\right)^2 = \frac{125}{4}$	✓ identifying PN as diameter ✓ coordinates of centre ✓ r^2 ✓ equation of the circle	(4)

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QUESTION 4



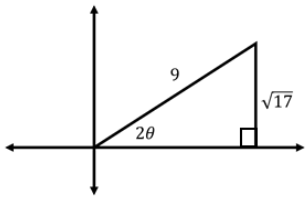
	SOLUTIONS	MARK DESCRIPTIONS	MARKS
4.1	$x^2 + 4x + y^2 - 2y = -k$ $x^2 + 4x + 4 + y^2 - 2y + 1 = 4 + 1 - k$ $(x+2)^2 + (y-1)^2 = 5 - k$ Radius: $r = \sqrt{5-k}$	✓ $-k$ ✓ r^2 ✓ answer	(3)
4.2	N$(-2; 1)$	✓ x – value ✓ y – value	(2)
4.3	NM $= \sqrt{(2+2)^2 + (-2-1)^2}$ NM $= 5$ units **Answer Only Full marks**	✓ substitution ✓ answer	(2)
4.4	NT $= 5 - 2 = 3$ $\sqrt{5-k} = 3$ $5 - k = 9$ $\therefore k = -4$ **OR** MN $=$ TN $+$ TM $5 = \sqrt{5-k} + 2$ $\left(\sqrt{5-k}\right)^2 = (3)^2$ $5 - k = 9$ $\therefore k = -4$	✓ NT $= 3$ ✓ equating ✓ answer ✓ applying rule for circle ✓ squaring both sides ✓ answer	(3)

4.5	$m_{\text{TM}} = \frac{-2+\frac{4}{5}}{2-\frac{2}{5}}$ **OR** $m_{\text{NT}} = \frac{1+\frac{4}{5}}{-2-\frac{2}{5}}$ $\therefore m_{\text{TM}} = -\frac{3}{4}$ $\therefore m_{\text{NT}} = -\frac{3}{4}$ $m_{\text{TM}} \times m_{\text{BT}} = -1$ $m_{\text{NT}} \times m_{\text{BT}} = -1$ $\therefore m_{BT} = \frac{4}{3}$ $\frac{4}{3} = \frac{4+\frac{4}{5}}{x-\frac{2}{5}}$ $4x - \frac{8}{5} = \frac{72}{5}$ $4x = 16$ $x = 4$ $y = 4$ **OR** $m_{\text{TM}} = \frac{-2+\frac{4}{5}}{2-\frac{2}{5}}$ **OR** $m_{\text{NT}} = \frac{1+\frac{4}{5}}{-2-\frac{2}{5}}$ $\therefore m_{\text{TM}} = -\frac{3}{4}$ $\therefore m_{\text{NT}} = -\frac{3}{4}$ $m_{\text{TM}} \times m_{\text{BT}} = -1$ $m_{\text{NT}} \times m_{\text{BT}} = -1$ $\therefore m_{BT} = \frac{4}{3}$ $y = \frac{4}{3}x + c$ subs point T$\left(\frac{2}{5}; -\frac{4}{5}\right)$ $-\frac{4}{5} = \frac{4}{3}\left(\frac{2}{5}\right) + c$ **OR** $y + \frac{4}{5} = \frac{4}{3}\left(x - \frac{2}{5}\right)$ $\therefore c = -\frac{4}{3}$ $y = \frac{4}{3}x - \frac{4}{3}$ $y = \frac{4}{3}x - \frac{4}{3}$ . . . . . (1) $y = 4$ . . . . . (2) $\frac{4}{3}x - \frac{4}{3} = 4$ $4x - 4 = 12$ $4x = 16$ $\therefore x = 4$ $\therefore$ B(4; 4) **OR**	✓ $m_{\text{TM}} = -\frac{3}{4}$ or $m_{\text{NT}} = -\frac{3}{4}$ ✓ $m_{\text{BT}} = \frac{4}{3}$ ✓value of y ✓ substitution into gradient formula ✓simplify ✓ value of x **OR** ✓ $m_{\text{TM}} = -\frac{3}{4}$ or $m_{\text{NT}} = -\frac{3}{4}$ ✓ $m_{\text{BT}} = \frac{4}{3}$ ✓ $y = 4$ ✓ substitute gradient and point T ✓ $y = \frac{4}{3}x - \frac{4}{3}$ ✓ simplification **OR**	(6) (6)

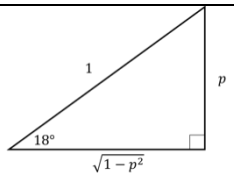
	AB = BR tangent from same point $y = 4$ $\sqrt{(-2-x)^2+(4-4)^2} = \sqrt{\left(x-\frac{2}{5}\right)^2+\left(4+\frac{4}{5}\right)^2}$ $4+4x+x^2 = x^2-\frac{4}{5}x+\frac{4}{25}+\frac{576}{25}$ $\frac{24}{5}x = \frac{96}{5}$ $x = 4$	✓ AB = BR ✓ $y = 4$ ✓ substitution for AB ✓ substitution for BR ✓ simplification ✓ simplification	(6)
4.6	M′ (2; 1) AB = 6 units NM′ = 4 units AN = 3 units Area of trapezium $= \frac{1}{2}$ (AB + NM′)AN $= \frac{1}{2}(6+4)3$ = 15 square units	✓ M′ (2; 1) ✓ length of AB ✓ length of NM′ and AN ✓ substitution into the formula ✓ answer	(5)

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QUESTION 5

	SOLUTIONS	MARK DESCRIPTIONS	MARKS
5.1.1	 $x^2 = 9^2 - \left(\sqrt{17}\right)^2$ $x^2 = 64$ $x = 8$ $\cos 2\theta = \frac{8}{9}$	✓ $x = 8$ ✓ answer	(2)
5.1.2	$\sin(2\theta - 45°) = \sin 2\theta \cos 45° - \cos 2\theta \sin 45°$ $= \left(\frac{\sqrt{17}}{9}\right)\left(\frac{\sqrt{2}}{2}\right) - \left(\frac{8}{9}\right)\left(\frac{\sqrt{2}}{2}\right)$ $= \frac{\sqrt{34}}{18} - \frac{8\sqrt{2}}{18}$ $= \frac{\sqrt{34}-8\sqrt{2}}{18}$	✓ correct compound expansion ✓ substitution ✓ answer	(3)
5.1.3	$\cos 2\theta = 2\cos^2\theta - 1$ $2\cos^2\theta = \cos 2\theta + 1$ $\cos\theta = \sqrt{\frac{\cos 2\theta + 1}{2}}$ $= \sqrt{\frac{\left(\frac{8}{9}\right)+1}{2}}$ $= \frac{\sqrt{34}}{6}$ or $\sqrt{\frac{17}{18}}$ **OR** $\cos 2\theta = 2\cos^2\theta - 1$ $\frac{8}{9} = 2\cos^2\theta - 1$ $\frac{17}{9} = 2\cos^2\theta$ $\frac{17}{18} = \cos^2\theta$ $\therefore \cos\theta = \sqrt{\frac{17}{18}}$	✓ double angle ✓ substitution of $\cos 2\theta$ ✓ answer **OR** ✓ double angle ✓ substitution of $\cos 2\theta$ ✓ answer	(3) (3)

5.2.1	$\sin 198° = \sin(180° + 18°)$ $= -\sin 18°$ $= -p$	 ✓reduction ✓ answer	 (2)

5.2.2	$x^2 = 1^2 - p^2$ Pyth $x = \sqrt{1-p^2}$  $\tan 522° = \tan 162°$ $= -\tan 18°$ $= -\frac{p}{\sqrt{1-p^2}}$	✓ $x = \sqrt{1-p^2}$ ✓ $-\tan 18°$ ✓ answer	 (3)
5.2.3	$\sin 9° \cos 9° = \frac{1}{2}(2\sin 9° \cos 9°)$ $= \frac{1}{2}\sin 2(9°)$ $= \frac{1}{2}\sin 18°$ $= \frac{p}{2}$	✓ $\frac{1}{2}(2\sin 9° \cos 9°)$ ✓ $\frac{1}{2}\sin 18°$ ✓ answer	 (3)

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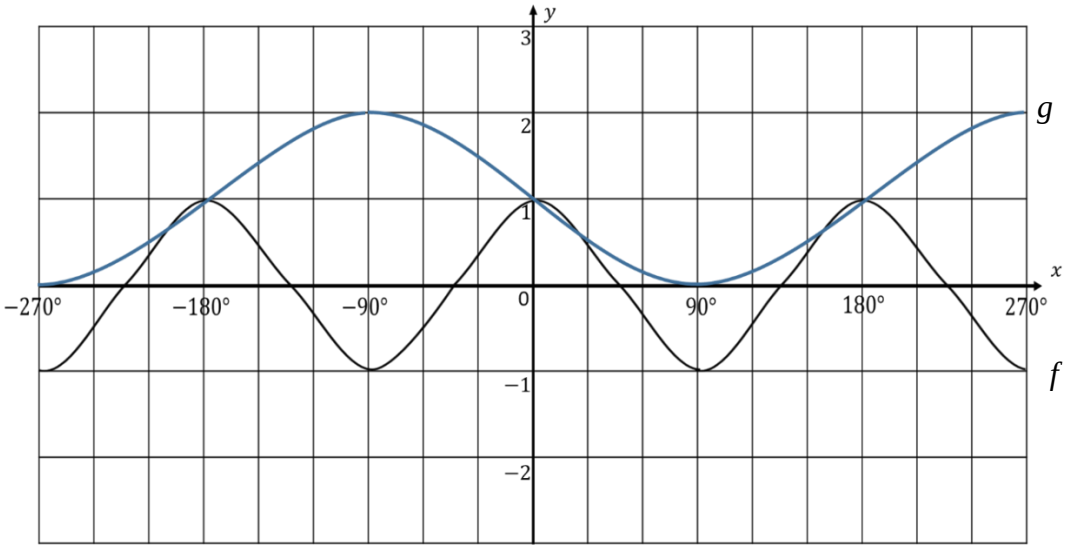
QUESTION 6

	SOLUTIONS	Mark descriptions	Marks
6.1	$\frac{\sin 100° \tan^2 225°}{\cos 10° \sin 30°}$ $= \frac{\cos 10° \tan^2 45°}{\cos 10° \sin 30°}$ OR $= \frac{\sin 80° \tan^2 45°}{\sin 80° \sin 30°}$ $= \frac{1}{\frac{1}{2}}$ $= 2$	✓ $\cos 10° / \sin 80°$ ✓ $\tan 45°$ ✓ substitution ✓ answer	(4)
6.2	LHS = $\frac{\cos^2\theta - \cos\theta - \sin^2\theta}{2\sin\theta\cos\theta + \sin\theta}$ $= \frac{\cos^2\theta - \cos\theta - (1 - \cos^2\theta)}{\sin\theta(2\cos\theta + 1)}$ $= \frac{2\cos^2\theta - \cos\theta - 1}{\sin\theta(2\cos\theta + 1)}$ $= \frac{(2\cos\theta + 1)(\cos\theta - 1)}{\sin\theta(2\cos\theta + 1)}$ $= \frac{\cos\theta - 1}{\sin\theta}$ $= \frac{\cos\theta}{\sin\theta} - \frac{1}{\sin\theta}$ $= \frac{1}{\tan\theta} - \frac{1}{\sin\theta}$ **OR** RHS: $\frac{1}{\tan\theta} - \frac{1}{\sin\theta}$ $= \frac{\cos\theta}{\sin\theta} - \frac{1}{\sin\theta}$ $= \frac{\cos\theta - 1}{\sin\theta}$ LHS: = $\frac{\cos^2\theta - \cos\theta - \sin^2\theta}{2\sin\theta\cos\theta + \sin\theta}$ $= \frac{\cos^2\theta - \cos\theta - (1 - \cos^2\theta)}{\sin\theta(2\cos\theta + 1)}$ $= \frac{2\cos^2\theta - \cos\theta - 1}{\sin\theta(2\cos\theta + 1)}$ $= \frac{(2\cos\theta + 1)(\cos\theta - 1)}{\sin\theta(2\cos\theta + 1)}$ $= \frac{\cos\theta - 1}{\sin\theta}$	✓ $1 - \cos^2\theta$ ✓ $\sin\theta(2\cos\theta + 1)$ ✓ $(2\cos\theta + 1)(\cos\theta - 1)$ ✓ $\frac{\cos\theta - 1}{\sin\theta}$ **OR** ✓ $\frac{\cos\theta - 1}{\sin\theta}$ ✓ $1 - \cos^2\theta$ ✓ $\sin\theta(2\cos\theta + 1)$ ✓ $(2\cos\theta + 1)(\cos\theta - 1)$	(4) (4)

6.3	$x^2 - y^2 = \sin^2 76° - \cos^2 76°$ $= -(\cos^2 76° - \sin^2 76°)$ $= -\cos 2(76°)$ $= -\cos 152°$ $= -(-\sin 62°)$ $= \sin 62°$ **OR** $\sin 62° = \sin(90° - 28°)$ $= \cos 28°$ $= \cos 2(14°)$ $= \cos^2 14° - \sin^2 14°$ $= \sin^2 76° - \cos^2 76°$ $= x^2 - y^2$ **OR** $\sin^2 76° - \cos^2 76° = \sin^2(45° + 31°) - \cos^2(45° + 31°)$ $= (\sin 45° \cos 31° + \cos 45° \sin 31°)^2 - (\cos 45° \cos 31° - \sin 45° \sin 31°)^2$ $= \left(\frac{1}{\sqrt{2}}\cos 31° + \frac{1}{\sqrt{2}}\sin 31°\right)^2 - \left(\frac{1}{\sqrt{2}}\cos 31° - \frac{1}{\sqrt{2}}\sin 31°\right)^2$ $= \frac{1}{2}\cos^2 31° + \cos 31° \sin 31° + \frac{1}{2}\sin^2 31° - (\frac{1}{2}\cos^2 31° + \cos 31° \sin 31° + \frac{1}{2}\sin^2 31°$ $= 2 \sin 31° \cos 31°$ $= \sin 62°$	✓ substitution ✓ $-(\cos^2 76° - \sin^2 76°)$ ✓ $-\cos 2(76°)$ ✓ $= -(-\sin 62°)$ **OR** ✓ $\cos 28°$ ✓$\cos^2 14° - \sin^2 14°$ ✓$\sin^2 76°$ ✓$\cos^2 76°$ **OR** ✓ compound expansion ✓ compound expansion ✓ simplification ✓ $2 \sin 31° \cos 31°$	(4) (4)

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QUESTION 7

	SOLUTIONS	MARK DESCRIPTIONS	MARKS
7.1	$180°$	✓ $180°$	(1)
7.2	$y \in [-3; 3]$ **OR** $-3 \leq y \leq 3$ **Award Notation mark only if CV correct**	✓✓ answer **OR** ✓✓ answer	(2) (2)
7.3	✓ turning points ✓ intercepts ✓ shape		(3)
			
7.4	$\cos 2x = 1 - \sin x$ $1 - 2\sin^2 x = 1 - \sin x$ $2\sin^2 x - \sin x = 0$ $\sin x\,(2\sin x - 1) = 0$ $\sin x = 0$ or $2\sin x - 1 = 0$ $\sin x = \frac{1}{2}$ For $\sin x = 0$: $x = k.180°; k \in \mathbb{Z}$ or $x = k.360°;\ k \in \mathbb{Z}$ or $x = 180° + k.360°;\ k \in \mathbb{Z}$ For $\sin x = \frac{1}{2}$: $x = 30° + k.360°;\ k \in \mathbb{Z}$ or $x = 150° + k.360°;\ k \in \mathbb{Z}$	✓ $\cos 2x = 1 - 2\sin^2 x$ ✓ standard form ✓ both equations for $\sin x$ ✓ $x = k.180°; k \in \mathbb{Z}$ $x = k.360°;\ k \in \mathbb{Z}$ or $x = 180° + k.360°; k \in \mathbb{Z}$ ✓ $x = 30°$ & $150°$ ✓ $k.360°$ $k \in \mathbb{Z}$	(6)

7.5.1	$x \in \{90°; 180°; 270°\}$	✓90°; 180° ✓ 270°	(2)
7.5.2	$x = 150°$	✓ answer	(1)

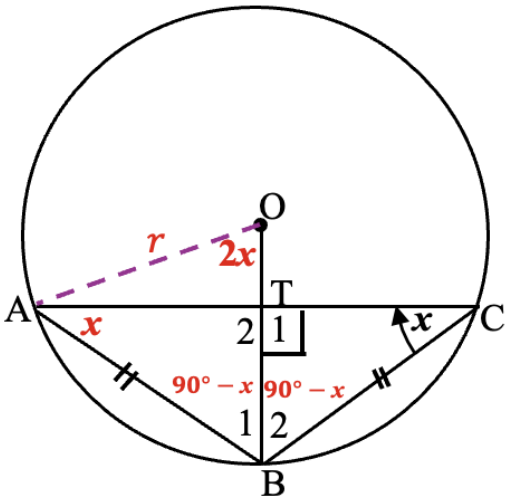
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QUESTION 8

	SOLUTIONS	**MARK DESCRIPTIONS**	**MARKS**
8.1	$\tan\theta = \frac{PQ}{QR}$ $PQ = QR\tan\theta$	✓ correct trig ratio ✓ answer	(2)
8.2	$\frac{QR}{\sin\beta} = \frac{8}{\sin(180°-(\alpha+\beta))}$ $QR = \frac{8\sin\beta}{\sin(\alpha+\beta)}$	✓ correct use of sine rule ✓ $\hat{Q} = 180° - (\alpha + \beta)$	(2)
8.3	$PQ = QR\tan\theta$ $PQ = \frac{8\sin\beta}{\sin(\alpha+\beta)} \times \tan\theta$ $PQ = \frac{8\sin\beta}{\sin 2\beta} \times \frac{\sin\theta}{\cos\theta}$ $PQ = \frac{8\sin\beta\sin\theta}{2\sin\beta\cos\beta\cos\theta}$ $PQ = \frac{4\sin\theta}{\cos\beta\cos\theta}$	✓ substitution of QR ✓ $\frac{\sin\theta}{\cos\theta}$ ✓ $\sin 2\beta$ ✓ $\sin 2\beta = 2\sin\beta\cos\beta$	(4)
8.4	$PQ = \frac{4\sin\theta}{\cos\beta\cos\theta}$ $PQ = \frac{4\sin 25°}{\cos 67°\cos 25°}$ $PQ = 4{,}77\text{m}$	✓ correct substitution of θ and β ✓ answer	(2)

[10]

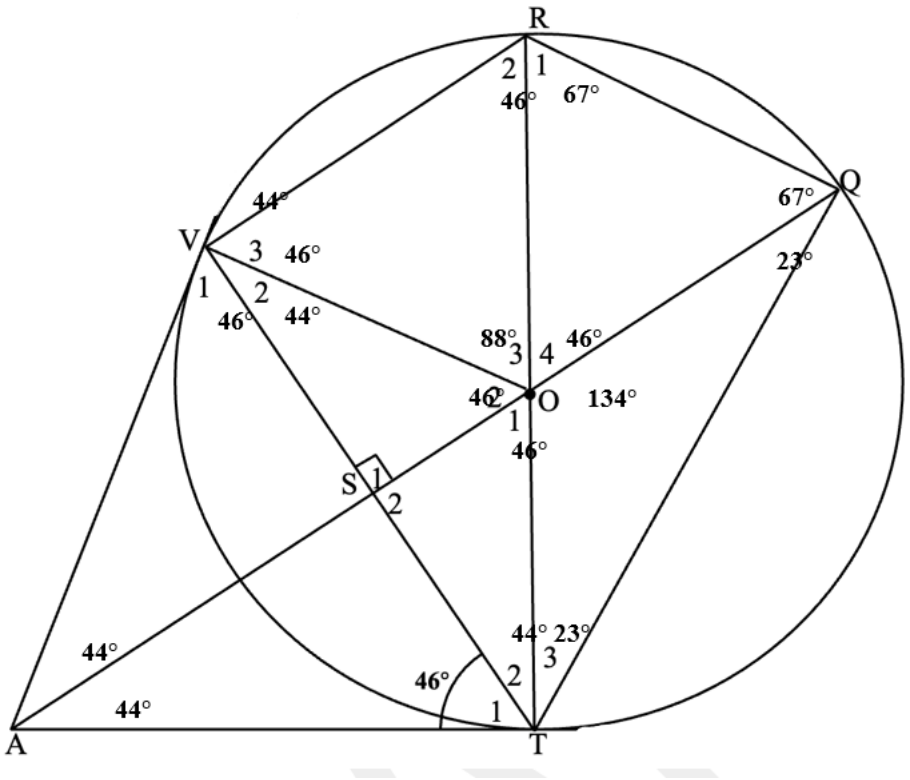
QUESTION 9



	SOLUTIONS	MARK DESCRIPTIONS	MARKS
9.1	$\hat{B}_2 = 90° - x$ [sum of angles of Δ]	✓ S ✓R	(2)
9.2	$\hat{A} = \hat{C} = x$ [$\angle$s opp equal sides] $\hat{B}_1 = \hat{B}_2 = 90° - x$ [exterior $\angle$ of Δ] $\therefore \hat{B}_1 = \hat{B}_2$ $\therefore$ OB bisects $A\hat{B}C$	✓ S ✓ S/R	(2)
9.3	AT = TC [line from centre perpendicular to chord] In Δ AOT OB = OA = r [radii] $\therefore OT = \frac{r}{4}$ $AT^2 = (r)^2 - \left(\frac{r}{4}\right)^2$ [Pythagoras] $AT^2 = r^2 - \frac{r^2}{16}$ $AT = \sqrt{\frac{15r^2}{16}}$ $\therefore AT = TC = \frac{\sqrt{15}}{4}$ $\therefore AC = \frac{\sqrt{15}}{2}r$	✓ S/R ✓ OT = $\frac{r}{4}$ ✓ length of AT ✓ answer	(4)

[8]

QUESTION 10

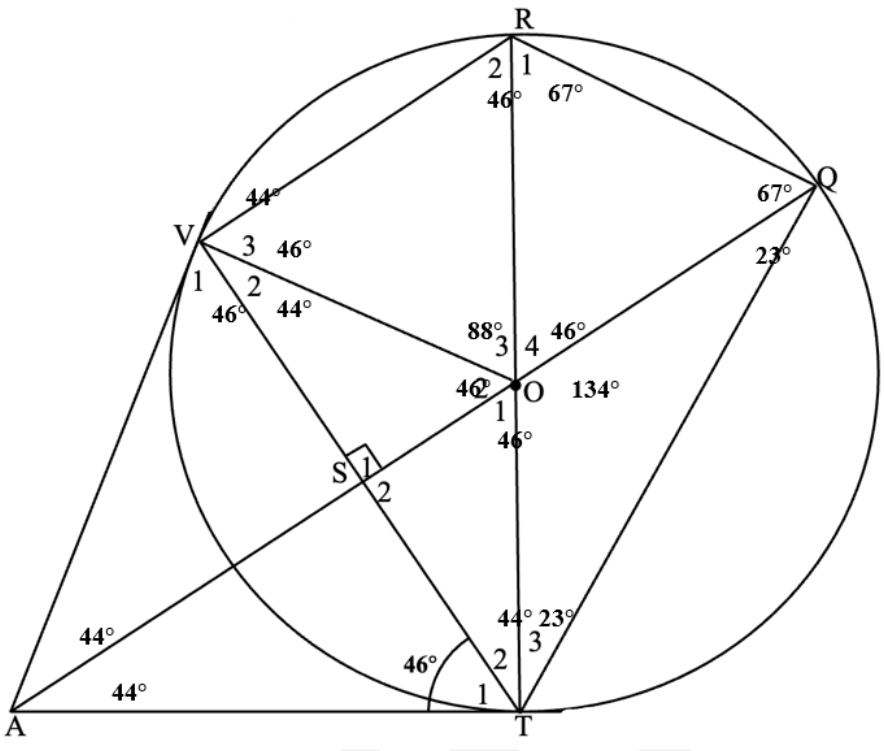


	SOLUTIONS		MARK DESCRIPTIONS	MARKS
10.1.1	$\hat{R}_2 = 46°$	[tan chord theorem]	✓ S ✓ R	(2)
10.1.2	$\hat{T}_1 + \hat{T}_2 = 90°$	[tangent ⊥ radius OR tangent ⊥ diameter]	✓ S/R	
	$\hat{T}_2 = 44°$			
	$\therefore \hat{O}_1 = 46°$	[ext ∠ of Δ]	✓ S	
	$\hat{O}_4 = 46°$	[vert opp ∠s]	✓ S	
	$\therefore \hat{T}_3 = 23°$	[∠ at centre = 2 × ∠ at circumference]	✓S ✓ R	(5)
		OR	**OR**	
	$\hat{V}_2 + \hat{V}_3 = 90°$	[∠s in a semi circle]	✓ S/R	
	$\hat{V}_2 + \hat{V}_3 + \hat{S}_1 = 90°$			
	$\therefore RV \parallel SO$	[co – int ∠s sup]	✓ S	
	$\hat{O}_4 = 46°$	[alt ∠s; RV ∥ SO]	✓ S	
	$\hat{T}_3 = 23°$	[∠ at centre = 2 × ∠ at circ]	✓S ✓ R	(5)

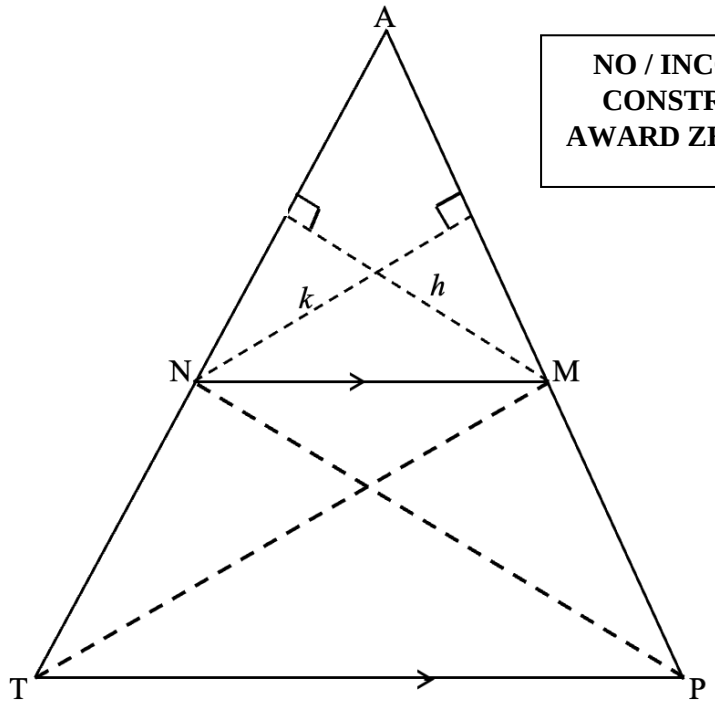
10.2	$\hat{V}_2 = 44°$ [∠s opp radii] $\hat{S}_1 = 90°$ [given] $\hat{O}_2 = 46°$ [sum of ∠s in Δ] $\therefore \quad \hat{O}_2 = \hat{T}_1 = 46°$ ∴ TAVO is a cyclic quad [converse ∠s in same seg **or** line subtends equal ∠s]	✓ S/R ✓ S ✓ S ✓ R	(4)

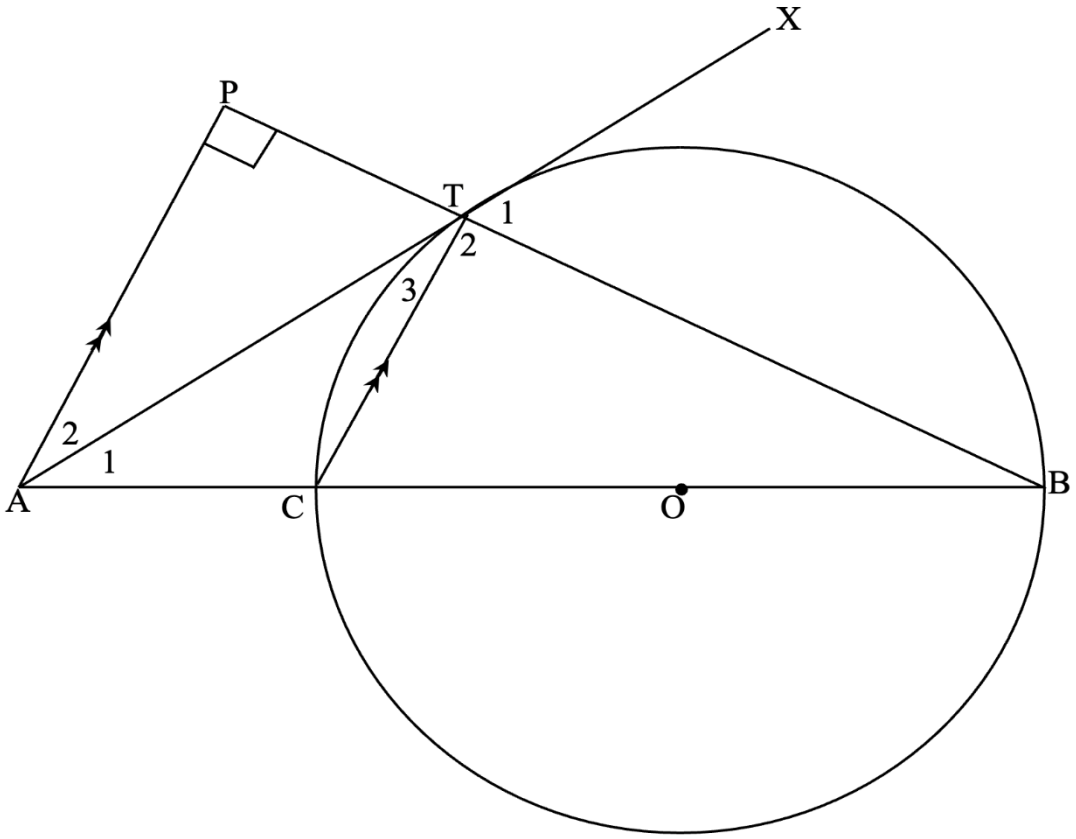
10.3	$\hat{O}_1 = \hat{V}_1 = 46°$ [∠s in same seg] $\therefore \hat{V}_1 = \hat{O}_2 = 46°$ ∴ VA is a tangent to the circle. [converse tan chord theorem **or** ∠ between line and chord]	✓S/R ✓ R	(2)

[13]

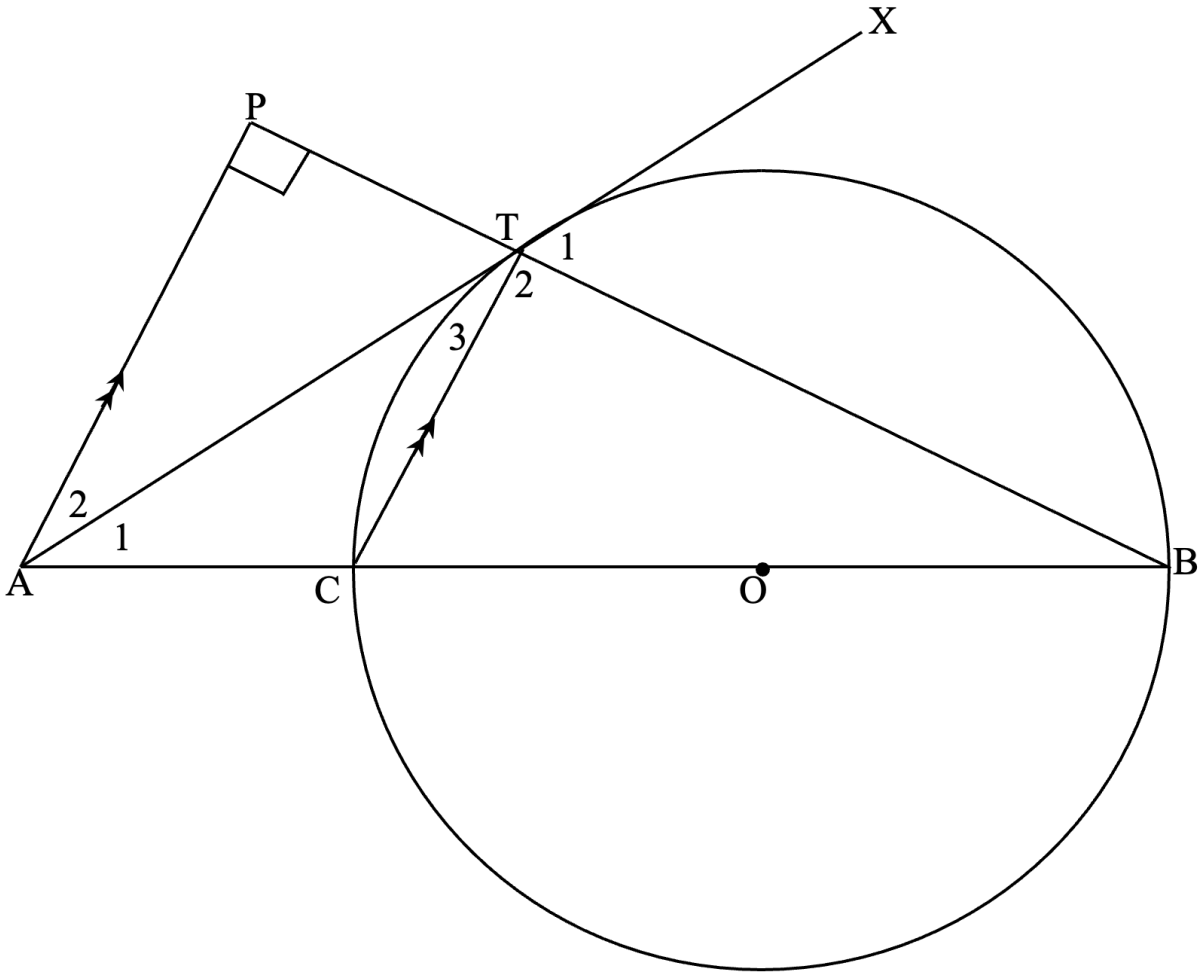


QUESTION 11

	SOLUTIONS	MARK DESCRIPTIONS	MARKS
11.1	Construction: In Δ ATP, draw perpendicular height *k* with base AM and perpendicular height *h* with base AN. Join TM and NP.		
	 **NO / INCOMPLETE CONSTRUCTION: AWARD ZERO MARKS**		
	Proof: $\frac{\text{Area } \Delta ANM}{\text{Area } \Delta TNM} = \frac{\frac{1}{2}.\ AN\ .h}{\frac{1}{2}.\ NT\ .h}$ $= \frac{AN}{NT}$ $\frac{\text{Area } \Delta ANM}{\text{Area } \Delta PNM} = \frac{\frac{1}{2}.\ AM\ .k}{\frac{1}{2}.\ MP\ .k}$ $= \frac{AM}{MP}$ Area ΔANM= Area ΔANM But Area ΔTNM = Area ΔPMN (same base and height) $\therefore \frac{\text{Area } \Delta ANM}{\text{Area } \Delta TNM} = \frac{\text{Area } \Delta ANM}{\text{Area } \Delta PNM}$ $\therefore \frac{AN}{NT} = \frac{AM}{MP}$	✓ construction ✓ $\frac{\text{Area } \Delta ANM}{\text{Area } \Delta TNM} = \frac{\frac{1}{2}.\ AN\ .h}{\frac{1}{2}.\ NT\ .h}$ ✓ $\frac{AN}{NT}$ ✓ $\frac{\text{Area } \Delta ANM}{\text{Area } \Delta PNM} = \frac{AM}{MP}$ ✓ S/R	(5)



	SOLUTIONS	**MARK DESCRIPTIONS**	**MARKS**
11.2.1	In Δ APT and Δ BPA (i) $\hat{P} = \hat{P}$ [common] (ii) $\hat{A}_2 = \hat{T}_3$ [alt. ∠s ; PA ‖ TC] $\hat{T}_3 = \hat{B}$ [tan chord theorem] $\therefore \hat{A}_2 = \hat{B}$ (iii) $A\hat{T}P = P\hat{A}B$ [sum of ∠s in Δ] ∴ Δ APT ||| Δ BPA [∠ ∠ ∠]	✓S ✓ S ✓ S/R ✓3rd S or R (∠ ∠ ∠)	(4)
11.2.2	$\frac{BT}{PT} = \frac{CB}{AC}$ [prop theorem; PA ‖ TC / line ‖ one side of Δ] $\frac{3AC}{PT} = \frac{CB}{AC}$ $3AC^2 = PT.CB$ $AC^2 = \frac{PT.CB}{3}$ $\therefore AC = \sqrt{\frac{PT.CB}{3}}$	✓ S ✓R ✓substitute BT = 3AC	(3)



	SOLUTIONS	MARK DESCRIPTIONS	MARKS
11.2.3	$\frac{BP}{TB} = \frac{AP}{TC}$ Δ TBC ||| Δ PBA	✓ S/R	
	$\therefore AP = \frac{BP.TC}{TB}$	✓ S	
	$\frac{AP}{BP} = \frac{PT}{AP}$ Δ APT ||| Δ BPA	✓ S	
	$\therefore AP^2 = BP.PT$	✓ S	
	$\left(\frac{BP.TC}{TB}\right)^2 = BP.PT$	✓ $\left(\frac{BP.TC}{TB}\right)^2 = BP.PT$	
	$\frac{BP^2.TC^2}{TB^2} = BP.PT$		
	$PT = \frac{BP^2.TC^2}{BP.\ TB^2}$	✓ $PT = \frac{BP^2.TC^2}{BP.\ TB^2}$	
	$\therefore PT = \frac{BP.TC^2}{TB^2}$		(6)

[18]

TOTAL: 150

FINAL

KWAZULU-NATAL PROVINCE

EDUCATION

REPUBLIC OF SOUTH AFRICA

PROVINCIAL STANDARDISED ASSESSEMENT

GRADE 12

MATHEMATICS P2

SEPTEMBER 2026

PREPARATORY EXAMINATION

MARKING GUIDELINES

MARKS: 150

These marking guidelines consist of 15 pages.

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QUESTION 1

1.1	$\overline{x} = \frac{107}{10}$ $= 10,7$ Answer only: Full marks	✓A $\overline{x} = \frac{107}{10}$ ✓CA answer (2)
1.2	$a = 49,51$ $b = 2,62$ $\hat{y} = 49,51 + 2,62x$	✓A value of a ✓A value of b ✓CA equation (3)
1.3	$r = 0,96$ Penalty for incorrect rounding: Only in this question.	✓A answer (1)
1.4	There is a very strong correlation between gym hours and maximum performance minutes.	✓CA very strong (1)
1.5	$\hat{y} = 49,51 + 2,62(4)$ $= 59,99$ minutes **OR** 59,97 minutes (from calculator)	✓CA substitution ✓CA answer (2) **OR** ✓✓A A answer (2)
1.6	Increase	✓A answer (1)
		[10]

QUESTION 2

2.1	200	✓A answer (1)
2.2.1	R3920	✓A answer (accept: R3850 – R4000) (1)
2.2.2	No. of Bolt vehicles for which fares are R5000 or less = 153 No of Bolt vehicles for which fares are more than R5000 $= 200 - 153$ $= 47$	✓A 153 (accept: 150 – 155) ✓CA subtraction ✓CA answer (accept: 45 – 50) (3)
2.3	20% of $200 = 40$ Reading from the graph this equates to R2425 in fares. distance travelled $= \frac{2425}{25}$ $= 97$ km $\therefore x = 97$	✓A 40 ✓CA amount in fares (accept: R2400 – R2450) ✓CA dividing amount by 25 ✓CA answer (accept: 96 to 98 km) (4)
		[9]

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QUESTION 3

3.1.1	Midpoint of EH $=\left(\frac{-2+2}{2};\frac{-3+0}{2}\right)$ $=\left(0;\frac{-3}{2}\right)$ Answer only: Full marks	✓A x-value ✓A y-value (2)
3.1.2	$m_{EF}=\frac{-5-(-3)}{2-(-2)}$ $=\frac{-1}{2}$ Answer only: Full marks	✓A substitution ✓CA answer (2)
3.1.3	$m_{DG}=m_{EF}=\frac{-1}{2}$ [DG ‖ EF] $y=mx+c$ Substitute $(2;0)$: $0=\left(\frac{-1}{2}\right)(2)+c$ $c=1$ $\therefore y=\frac{-1}{2}x+1$	✓CA $m_{DG}=\frac{-1}{2}$ ✓CA substitution ✓CA answer (3)
3.1.4	$m_{DG}=\tan D\hat{H}C=-\frac{1}{2}$ $D\hat{H}C=153,43°$ $\alpha=180°-153,43°=26,57°$ [$\angle$s on a straight line] $\theta=90°+26,57°=116,57°$ [ext $\angle$ of ΔDOH]	✓CA $\tan D\hat{H}C=-\frac{1}{2}$ ✓CA size of $D\hat{H}C$ ✓CA size of θ (3)
3.2	$D(0;1)$ $m_{DE}=\frac{-3-1}{-2-0}=2$ $m_{DE}\times m_{DG}=2\times-\frac{1}{2}=-1$ $\therefore DE\perp DG$	✓CA coordinates of D ✓CA $m_{DE}=2$ ✓A showing that product of gradients $=-1$ (3)
3.3.1	$\left(0;\frac{-3}{2}\right)$	✓CA answer (1)

3.3.2	$(x-0)^2+\left[y-\left(-\frac{3}{2}\right)\right]^2=r^2$ $x^2+\left(y+\frac{3}{2}\right)^2=r^2$ $r^2=(2-0)^2+\left[0-\left(-\frac{3}{2}\right)\right]^2$ $=4+\frac{9}{4}=\frac{25}{4}$ $\therefore x^2+\left(y+\frac{3}{2}\right)^2=\frac{25}{4}$ Answer only: 3/4	✓CA substitution of coordinates of centre ✓CA substitution of $\mathrm{H}(2\,;0)$ ✓CA value of r^2 ✓CA equation of circle (4)
		[18]

QUESTION 4

4.1	$(x-4)^2+(y-6)^2=10^2$ $(-4-4)^2+(p-6)^2=10^2$ $(p-6)^2=36$ $p-6=\pm\sqrt{36}$ **OR** $p^2-12p+36=36$ $p-6=6$ or $p-6=-6$ $p(p-12)=0$ $p=12$ or $p\neq 0$ $p=12$ or $p\neq 0$ $\therefore p=12$ $\therefore p=12$	✓A equation of the circle/distance formula ✓CA substitution of point J ✓CA simplification ✓A $p-6=\pm\sqrt{36}$ **OR** $p(p-12)=0$ (4)
4.2.1	$\mathrm{C}(4\,;6-10)$ $\therefore \mathrm{C}(4\,;-4)$ Answer only: Full marks	✓A x-coordinate ✓A y-coordinate (2)
4.2.2	$m_{\mathrm{MJ}}=\frac{12-6}{-4-4}=-\frac{3}{4}$ $\therefore m_{\mathrm{AJB}}=\frac{4}{3}$ [radius $\perp$ tangent] $y=\frac{4}{3}x+c$ Subst. point J: $12=\frac{4}{3}(-4)+c$ $c=\frac{52}{3}$ $y=\frac{4}{3}x+\frac{52}{3}$	✓A gradient of radius ✓CA gradient of tangent ✓CA substitution of gradient and point J ✓CA equation of tangent (4)

4.2.3	$y_A = \frac{4}{3}(4) + \frac{52}{3} = \frac{68}{3}$	✓CA calculation of y_A
	$AC = y_A - y_C = \frac{68}{3} - (-4) = \frac{80}{3}$	✓CA length of AC
	Calculate x-coordinate of B:	
	$\frac{x_B + 4}{2} = -9$	✓CA calculation of x_B
	$\therefore x_B = -22$	✓CA value of x-coordinate of B
	height of $\Delta ABC \perp AC = 4 - (-22) = 26$ units	✓CA height of ΔABC
	$\therefore$ Area of $\Delta ABC = \frac{1}{2} \times \text{base} \times \text{height}$	
	$= \frac{1}{2} \times \frac{80}{3} \times 26$	✓CA substitution into area formula
	$= \frac{1040}{3} = 346,67$ units^2	✓CA answer (7)
	OR	**OR**
	Coordinates of A:	
	$y_A = \frac{4}{3}(4) + \frac{52}{3} = \frac{68}{3}$	✓CA calculation of y_A
	$AC = y_A - y_C = \frac{68}{3} - (-4) = \frac{80}{3}$	✓CA length of AC
	Coordinates of B:	
	$\frac{x_B + 4}{2} = -9$ $\quad\quad$ $\frac{-4 + y_B}{2} = -8$	
	$\therefore x_B = -22$ $\quad\quad$ $\therefore y_B = -12$	
	$\therefore B(-22; -12)$	✓CA values of coordinates of B
	Length of AB $= \sqrt{(-22-4)^2 + \left(-12 - \frac{68}{3}\right)^2} = \frac{130}{3}$	✓CA length of AB
	$\tan^{-1}\left(\frac{4}{3}\right) = 53,13°$	
	$\therefore \hat{A} = 180° - 90° - 53,13° = 36,87°$	✓CA size of $\hat{A}$
	$\therefore$ Area of $\Delta ABC = \frac{1}{2} AB.AC \sin A$	
	$= \frac{1}{2}\left(\frac{130}{3}\right)\left(\frac{80}{3}\right)\sin 36,87°$	✓CA substitution into area formula
	$= 346,67$ units^2	✓CA answer (7)

4.3	For circles touching externally, the distance between centres: $d = r_1 + r_2$ $(4-4)^2 + (6-n)^2 = (10+10)^2$ $36 - 12n + n^2 = 400$ $n^2 - 12n - 364 = 0$ $(n+14)(n-26) = 0$ $\therefore n = -14 \quad \text{or} \quad n = 26$ **OR** $n = 6 - 2(r)$ or $n = 6 + 2(r)$ $= 6 - 2(10)$ $= 6 + 2(10)$ $= -14$ $= 26$	✓A $d = r_1 + r_2$ ✓A substitution ✓A $n = -14$ ✓A $n = 26$ (4) **OR** ✓A $n = 6 - 2(r)$ ✓A $n = 6 + 2(r)$ ✓A $n = -14$ ✓A $n = 26$ (4)
		[21]

QUESTION 5

5.1.1	$x = -3$; $y = -\sqrt{7}$ $(-3)^2 + (-\sqrt{7})^2 = r^2$ [Pythagoras] $r^2 = 16$ $r = 4$ $\therefore \cos\alpha = \frac{-3}{4}$	✓A substitution ✓CA value of r ✓CA answer (3)
5.1.2	$\sin 3\alpha \cos 2\alpha - \cos 3\alpha \sin 2\alpha$ $= \sin(3\alpha - 2\alpha)$ $= \sin\alpha$ $= \frac{-\sqrt{7}}{4}$	✓A $\sin\alpha$ ✓CA answer (2)
5.2	$\frac{\sin 290°.\sin(90°+x).\sin 160°}{\cos(-x-360°).\sin 220°}$ $= \frac{(-\sin 70°).(\cos x).\sin 20°}{\cos x.(-\sin 40°)}$ $= \frac{-\cos 20°.\sin 20°}{-\sin 40°}$ $= \frac{\sin 20°\cos 20°}{2\sin 20°\cos 20°}$ $= \frac{1}{2}$	✓A $-\sin 70°$ and $\sin 20°$ ✓A $\cos x$ (in numerator) ✓A $\cos x$ (in denominator) ✓A $-\sin 40°$ ✓CA $\sin 70° = \cos 20°$ ✓CA double angle expansion ✓CA answer (7)

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5.3.1	$\dfrac{\frac{1}{4}-\cos(\theta-60°).\cos(\theta+60°)}{\sin 2\theta}$	
	$=\dfrac{\frac{1}{4}-\left[(\cos\theta\cos 60°+\sin\theta\sin 60°)(\cos\theta\cos 60°-\sin\theta\sin 60°)\right]}{2\sin\theta\cos\theta}$	✓A compound $\angle$ expansions ✓A double $\angle$ expansion
	$=\dfrac{\frac{1}{4}-\left[\cos^2\theta\cos^2 60°-\sin^2\theta\sin^2 60°\right]}{2\sin\theta\cos\theta}$	✓A simplifying numerator
	$=\dfrac{\frac{1}{4}-\cos^2\theta\left(\frac{1}{2}\right)^2+\sin^2\theta\left(\frac{\sqrt{3}}{2}\right)^2}{2\sin\theta\cos\theta}$	✓A special angle values
	$=\dfrac{\frac{1}{4}-\frac{1}{4}\cos^2\theta+\frac{3}{4}\sin^2\theta}{2\sin\theta\cos\theta}$	
	$=\dfrac{\frac{1}{4}(1-\cos^2\theta)+\frac{3}{4}\sin^2\theta}{2\sin\theta\cos\theta}$	✓A common factor
	$=\dfrac{\frac{1}{4}\sin^2\theta+\frac{3}{4}\sin^2\theta}{2\sin\theta\cos\theta}$	✓A using square identity
	$=\dfrac{\sin^2\theta}{2\sin\theta\cos\theta}$	✓A $\dfrac{\sin^2\theta}{2\sin\theta\cos\theta}$
	$=\frac{1}{2}\tan\theta$	
	$=$ RHS	(7)
5.3.2	Undefined at $\theta=90°$, because $\tan 90°$ is undefined.	
	Also undefined when $\sin 2\theta=0$ $2\theta=0°+k.180°$ $\therefore\theta=0°+k.90°$	
	Therefore, in the interval $\theta\in[0°;180°]$, the identity is undefined at: $\theta=0°;\ 90°;\ 180°$.	✓A $0°$ ✓A $90°$ ✓A $180°$ (3)
		[22]

QUESTION 6

6.1.1	$A(210°;-1)$	✓A $210°$; ✓A -1 (2)
6.1.2	$\sin(2x-60°)=1$ $2x-60°=90$ $2x=150°$ $x=75°$ $\therefore B(75°;1)$ **OR** $y=\sin(2x-60°)=\sin 2(x-30°)$ The graph of $y=\sin 2(x-30°)$ is obtained by translating the graph of $y=\sin 2x$ to the right by $30°$. $y=\sin 2x$ has a maximum turning point at $x=45°$. Therefore, the graph of $y=\sin(2x-60°)$ will have a maximum turning point at $x=45°+30°=75°$. Therefore, the coordinates of B will be $(75°;1)$.	✓A setting up equation ✓A x-coordinate ✓A y-coordinate (3) **OR** ✓A translation of $30°$ to the right ✓A x-coordinate ✓A y-coordinate (3)
6.2	$360°$	✓A answer (1)
6.3	Range of $y=\cos(x-30°)$ is $-1\le y\le 1$ $\therefore$ Range of $y=2^{\cos(x-30°)}$ is $\frac{1}{2}\le y\le 2$ Answer only: Full marks	✓A range of $\cos(x-30°)$ ✓✓CA CA answer (3)
6.4.1	$\frac{1}{2}\sin 2x-\frac{\sqrt{3}}{2}\cos 2x=\cos(x-30°)$ $\sin 2x\cos 60°-\cos 2x\sin 60°=\cos(x-30°)$ $\sin(2x-60°)=\cos(x-30°)$ $\sin(2x-60°)=\sin(90-(x-30°))$ $\sin(2x-60°)=\sin(120°-x)$ $2x-60°=120°-x+k.360°$ or $2x-60°=180°-(120°-x)+k.360°$ $3x=180°+k.360°$ $x=120°+k.360°,\ k\in Z$ $x=60°+k.120°,\ k\in Z$ **OR** $k\in Z$: at least once.	✓A special angles ✓A compound angle identity used ✓CA co-ratio ✓CA both equations ✓CA $x=120°+k.360°$ ✓CA $x=60°+k.120°$ (6) **OR**

	$\frac{1}{2}\sin 2x-\frac{\sqrt{3}}{2}\cos 2x=\cos(x-30°)$	
	$\sin 30°\sin 2x-\cos 30°\cos 2x=\cos(x-30°)$	✓A special angles
	$-(\cos 30°\cos 2x-\sin 30°\sin 2x)=\cos(x-30°)$	✓A compound angle identity used
	$-\cos(2x+30°)=\cos(x-30°)$	✓CA co-ratio
	$2x+30°=180°-(x-30°)+k.360°$ or $2x+30°=180°+(x-30°)+k.360°$	✓CA both equations
	$3x=180°+k.360°$ or $x=120°+k.360°,\ k\in Z$	✓CA $x=120°+k.360°$
	$x=60°+k.120°,\ k\in Z$	✓CA $x=60°+k.120°$ (6)
	OR	**OR**
	$\frac{1}{2}\sin 2x-\frac{\sqrt{3}}{2}\cos 2x=\cos(x-30°)$	
	$\cos 60°\sin 2x-\sin 60°\cos 2x=\cos(x-30°)$	✓A special angles
	$\sin 2x\cos 60°-\cos 2x\sin 60°=\cos(x-30°)$	
	$\sin(2x-60°)=\cos(x-30°)$	✓A compound angle identity used
	$\sin 2(x-30°)=\cos(x-30°)$	
	$2\sin(x-30°)\cos(x-30°)=\cos(x-30°)$	
	$\cos(x-30°)[2\sin(x-30°)-1]=0$	✓CA factorisation
	$\cos(x-30°)=0$ or $\sin(x-30°)=\frac{1}{2}$	✓CA all 3 equations
	$x-30°=90°+k.180°$ or $x-30°=30°+k.360°$ or $x-30°=150°+k.360°$	✓CA $x=120°+k.180°$ ✓CA $x=60°+k.360°$ and $x=180°+k.360°$
	$x=120°+k.180°\ k\in Z$ $x=60°+k.360°,\ k\in Z$ $x=180°+k.360°,\ k\in Z$	(6)
6.4.2	$60°$	✓CA answer (1)
		[16]

QUESTION 7

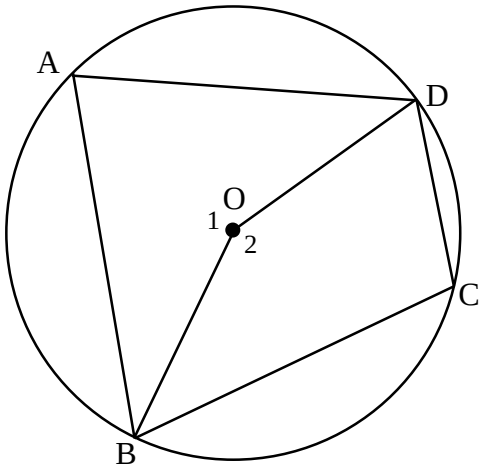
7.1	In ΔABC: $\frac{AB}{r} = \tan 2\theta$ $\therefore AB = r\tan 2\theta$ In ΔABD: $\frac{AB}{R} = \tan\theta$ $\therefore AB = R\tan\theta$ $\therefore r\tan 2\theta = R\tan\theta$ $R = \frac{r\tan 2\theta}{\tan\theta}$ $= \frac{(r)\frac{\sin 2\theta}{\cos 2\theta}}{\frac{\sin\theta}{\cos\theta}}$ $= \left(\frac{r.2\sin\theta\cos\theta}{2\cos^2\theta - 1}\right) \times \frac{\cos\theta}{\sin\theta}$ $= \frac{2r\cos^2\theta}{2\cos^2\theta - 1}$	✓A $\frac{AB}{r} = \tan 2\theta$ ✓A $\frac{AB}{R} = \tan\theta$ ✓A equating ✓A quotient identity ✓A double angle expansion ✓A double angle expansion (6)
7.2	$BD = \frac{2r\cos^2\theta}{2\cos^2\theta - 1} = \frac{2(2)\cos^2 30°}{2\cos^2 30° - 1} = 6$ m In ΔBCD: $CD^2 = BD^2 + BC^2 - 2BD.BC.\cos C\hat{B}D$ $7^2 = 6^2 + 2^2 - 2(6)(2)\cos C\hat{B}D$ $\cos C\hat{B}D = -\frac{9}{24}$ $C\hat{B}D = 112,02°$ Area of $\Delta BCD = \frac{1}{2}.BC.BD.\sin C\hat{B}D$ $= \frac{1}{2}(2)(6)\sin 112,02°$ $= 5,6\ m^2$ **OR**	✓A length of BD ✓CA substitution into cosine rule ✓CA value of $\cos C\hat{B}D$ ✓CA size of $C\hat{B}D$ ✓CA substitution into area rule ✓CA answer (6) **OR**

	$\text{BD} = \dfrac{2r\cos^2\theta}{2\cos^2\theta - 1} = \dfrac{2(2)\cos^2 30°}{2\cos^2 30° - 1} = 6 \text{ m}$	✓A length of BD
	In ΔBCD: $\text{BD}^2 = \text{BC}^2 + \text{CD}^2 - 2\text{BC.CD.cos}\,\hat{\text{BCD}}$	
	$6^2 = 2^2 + 7^2 - 2(2)(7)\cos\hat{\text{BCD}}$	✓CA substitution into cosine rule
	$\cos\hat{\text{BCD}} = \dfrac{17}{28}$	✓CA value of $\cos\hat{\text{BCD}}$
	$\hat{\text{BCD}} = 52,62°$	✓CA size of $\hat{\text{BCD}}$
	Area of $\Delta\text{BCD} = \dfrac{1}{2}\text{.BC.CD.sin}\,\hat{\text{BCD}}$	
	$= \dfrac{1}{2}(2)(7)\sin 52,62°$	✓CA substitution into area rule
	$= 5,6 \text{ m}^2$	✓CA answer (6)
	OR	**OR**
	$\text{BD} = \dfrac{2r\cos^2\theta}{2\cos^2\theta - 1} = \dfrac{2(2)\cos^2 30°}{2\cos^2 30° - 1} = 6 \text{ m}$	✓A length of BD
	In ΔBCD: $\text{BC}^2 = \text{BD}^2 + \text{CD}^2 - 2\text{BD.CD.cos}\,\hat{\text{BDC}}$	
	$2^2 = 6^2 + 7^2 - 2(6)(7)\cos\hat{\text{BDC}}$	✓CA substitution into cosine rule
	$\cos\hat{\text{BDC}} = \dfrac{81}{84}$	✓CA value of $\cos\hat{\text{BDC}}$
	$\hat{\text{BDC}} = 15,36°$	✓CA size of $\hat{\text{BDC}}$
	Area of $\Delta\text{BCD} = \dfrac{1}{2}\text{.BD.CD.sin}\,\hat{\text{BDC}}$	
	$= \dfrac{1}{2}(6)(7)\sin 15,36°$	✓CA substitution into area rule
	$= 5,6 \text{ m}^2$	✓CA answer (6)
		[12]

QUESTION 8

8.1.1	$A\hat{D}C = 67°$	[ext $\angle$ of cyclic quad]	✓S ✓R (2)
8.1.2	$\hat{A} = 67°$	[alt $\angle$s; BC || AD]	✓S ✓R (2)
8.1.3	$\hat{C} = 180° - 67°$ $= 113°$	[opp $\angle$s of cyclic quad]	✓ R ✓ S (2)
8.1.4	$\hat{B}_2 = \hat{A} = 67°$ $\hat{D}_1 = \hat{B}_2 = 67°$	[$\angle$s opp = sides] [tan-chord th]	✓S/R ✓S ✓R (3)
8.2	$\hat{D}_2 = \hat{B}_3$ $\therefore AB = CD$	[alt. $\angle$s; BC || AD] [converse: equal chords subtend equal angles]	✓S ✓R ✓R (3)
	OR		**OR**
	$\hat{D}_2 = 180° - (67° + 67°)$ $= 46°$	[sum of $\angle$s in Δ]	✓S/R
	$\hat{B}_3 = 180° - (67° + 67°)$ $= 46°$ $\hat{D}_2 = \hat{B}_3$	[$\angle$s on a str line]	✓S $\hat{B}_3 = 46°$
	$\therefore AB = CD$	[converse: equal chords subtend equal angles]	✓R (3)
			[12]

QUESTION 9

9.1		
	Construct radii OD and OB. $\hat{O}_1 = 2\hat{C}$ $[\angle \text{ at centre } = 2\times \angle \text{ at circumf}]$ $\hat{O}_2 = 2\hat{A}$ $[\angle \text{ at centre } = 2\times \angle \text{ at circumf}]$ $\hat{O}_1 + \hat{O}_2 = 360°$ [$\angle$s around a point] $\therefore 2\hat{C} + 2\hat{A} = 360°$ $\hat{C} + \hat{A} = 180°$ or: $\hat{A} + \hat{C} = 180°$	✓ construction ✓S ✓R ✓S/R ✓S (5)
9.2.1	$\hat{G}_2 = 90°$ $[\text{radius} \perp \text{tangent}]$ $\hat{H}_4 = 90°$ $[\text{line from centre to midpoint of chord}]$ $\hat{G}_2 + \hat{H}_4 = 180°$ $\therefore$ OGEH is a cyclic quadrilateral $[\text{converse opp } \angle\text{s of cyclic quad}]$ **OR** $\hat{G}_2 = 90°$ $[\text{radius} \perp \text{tangent}]$ $\hat{H}_1 = 90°$ $[\text{line from centre to midpoint of chord}]$ $\hat{G}_2 + \hat{H}_1 = 180°$ $\therefore$ OGEH is a cyclic quadrilateral $[\text{converse: exterior } \angle \text{ of cyclic quad}]$	✓S/R ✓S ✓R ✓R (4) **OR** S/R ✓S ✓R ✓R (4)
9.2.2	In ΔAHC and ΔDHC 1. AH = DH $[\text{given}]$ 2. HC = HC $[\text{common}]$ 3. $\hat{H}_2 = \hat{H}_3$ $[\text{both} = 90°]$ $\therefore \Delta AHC \equiv \Delta DHC$ [SAS] $\therefore \hat{C}_1 = \hat{C}_2$ $[\text{congruent } \Delta\text{s}]$	✓S ✓R ✓R (3)

9.2.3	$\hat{B} = A\hat{C}D = 2x$ $[\angle s \text{ in the same segment}]$ $\therefore \hat{C}_1 = \hat{C}_2 = x$ $[\text{proved}]$ $OA = OC$ $[\text{equal radii}]$ $G\hat{A}C = \hat{C}_1 = x$ $[\angle s \text{ opp} = \text{sides}]$ $\hat{O}_3 = 2x$ $[\text{ext } \angle \text{ of } \Delta]$ $\therefore \hat{E}_1 = 180° - 2x$ $[\text{opp } \angle s \text{ of cyclic quad}]$ **OR** $\hat{B} = A\hat{C}D = 2x$ $[\angle s \text{ in the same segment}]$ $\therefore \hat{C}_1 = \hat{C}_2 = x$ $[\text{proved}]$ $OA = OC$ $[\text{radii}]$ $G\hat{A}C = \hat{C}_1 = x$ $[\angle s \text{ opp} = \text{sides}]$ $\hat{A}_2 = 90° - x$ $[\text{sum of } \angle s \text{ of } \Delta]$ $\hat{A}_1 = x - \hat{A}_2 = 2x - 90°$ $\therefore \hat{E}_1 = 180° - (90° + 2x - 90°)$ $[\text{sum of } \angle s \text{ of } \Delta]$ $= 180° - 2x$	✓S ✓R ✓S/R ✓S/R ✓S ✓R (6) **OR** ✓S ✓R ✓S/R ✓S ✓S ✓R (6)
		[18]

QUESTION 10

10.1.1	$\frac{CE}{EA}=\frac{FC}{BF}$ $[\text{prop th , EF} \parallel \text{AB}]$ $\therefore \frac{CE}{EA}=\frac{3}{2}$	✓R ✓ answer (2)
10.1.2	In ΔEFC and ΔABC 1) $\hat{C}_2=\hat{C}_2$ $[\text{common}]$ 2) $\hat{E}_1=\hat{A}_1$ $[\text{corr } \angle\text{s , AB} \parallel \text{EF}]$ 3) $E\hat{F}C=\hat{B}$ $[\text{sum of } \angle\text{s in } \Delta]$ $\therefore \Delta EFC \mid\mid\mid \Delta ABC$ $[\angle\angle\angle]$ $\frac{EF}{AB}=\frac{FC}{BC}$ $[\mid\mid\mid \Delta\text{s}]$ $\therefore \frac{EF}{AB}=\frac{3}{5}$	✓S ✓S/R ✓R ✓S/R ✓S (5)
10.2	In ΔEGF and ΔCGD 1) $\hat{E}_1=\hat{C}_1$ $[\text{alt } \angle\text{s , EF} \parallel \text{CD}]$ 2) $\hat{F}_2=\hat{D}_2$ $[\text{alt } \angle\text{s , EF} \parallel \text{CD}]$ 3) $\hat{G}_3=\hat{G}_1$ $[\text{vert opp } \angle\text{s}]$ $\therefore \Delta EGF \mid\mid\mid \Delta CGD$ $[\angle\angle\angle]$ $\frac{EG}{CG}=\frac{EF}{CD}$ $[\mid\mid\mid \Delta\text{s}]$ But, $CD=AB$ $[\text{opp sides of parm ABCD}]$ $\therefore \frac{EG}{CG}=\frac{EF}{AB}$ $\therefore EG=\frac{CG.EF}{AB}$	✓S/R ✓S/R ✓S/R ✓S/R ✓S (5)
		[12]

TOTAL: 150 MARKS

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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)
	'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

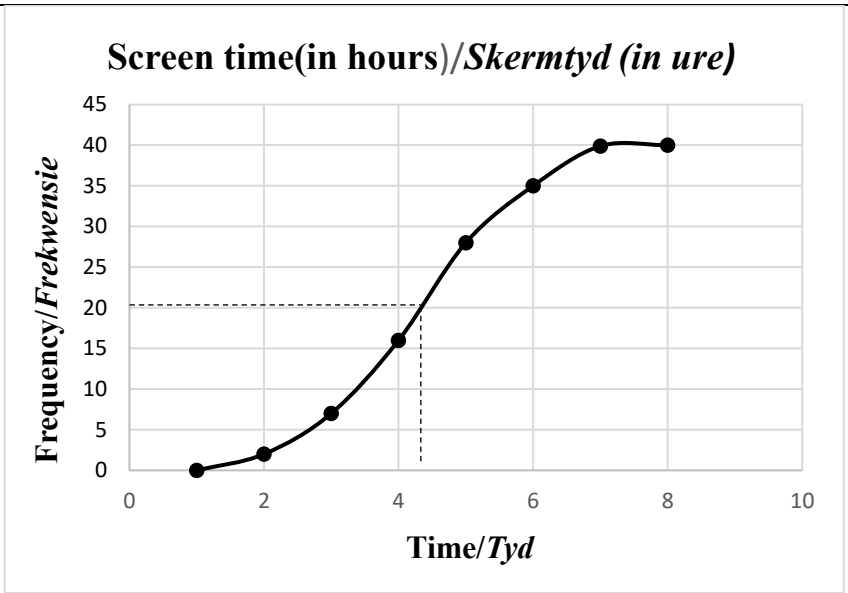
1.1

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)

1.2



✓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

$$\text{new/}nuwe\ \bar{x} = \frac{(1,5\times 2)+(2,5\times 5)+(3,5\times 33)}{40}$$

$$= \frac{131}{40}$$

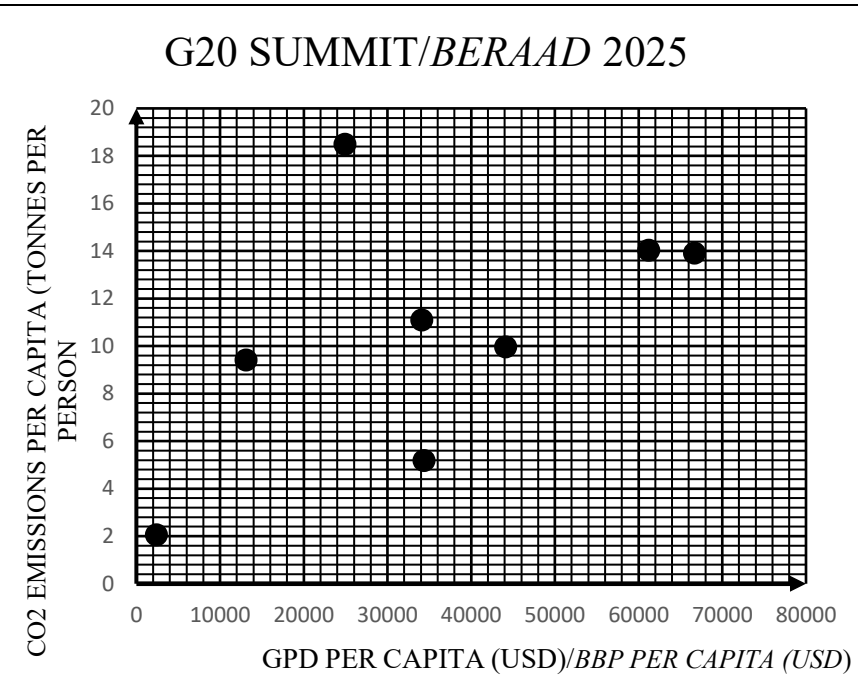
$$= 3,275$$

✓131

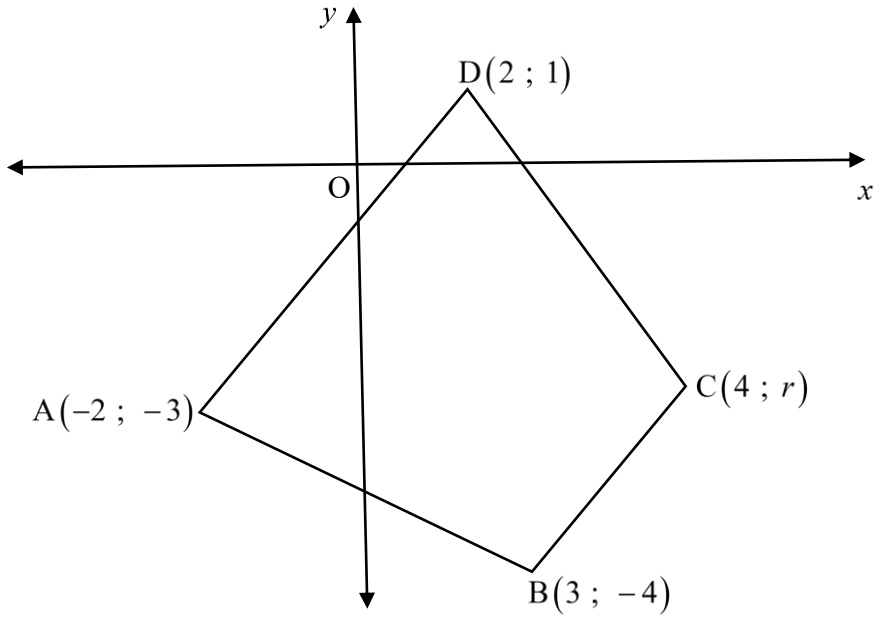
✓answer/*antwoord* (2)

[9]

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QUESTION/*VRAAG* 2		
2.1		✓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/*vergelyking* (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. *Nee, sommige lande is meer ontwikkel as ander en dit kan die Bruto Binnelandse Produk (BBP) per capita beïnvloed* *Of sommige lande is digter bevolk as ander.*	✓answer/*antwoord* (1)
		[10]

QUESTION/*VRAAG* 3



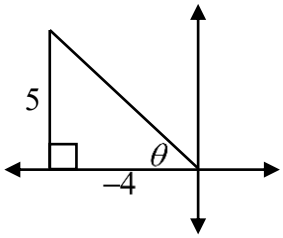
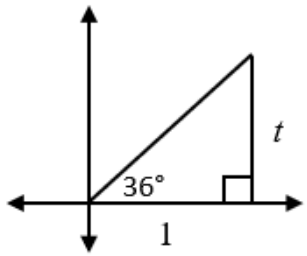
3.1	$x_M = \frac{-2+2}{2}$ $y_M = \frac{-3+1}{2}$ $x_M = 0$ $y_M = -1$	✓value x/*waarde* x ✓value y/*waarde* y (2)
3.2	$y - y_1 = m(x - x_1)$ $m(BP) = \frac{-4-(-1)}{3-0} = -1$ $y-(-4) = -1(x-3)$ or/*of* $y-(-1) = -1(x-0)$ $y+4 = -x+3$ $y+1 = -x$ $y = -x-1$ $y = -x-1$	✓$m(AP)$ ✓subst in formula/*vervang 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)

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

QUESTION/*VRAAG* 4		
4.1	$\tan \hat{P} = \frac{1}{3}$ $\hat{P} = 18,43°$ $Q\hat{P}V = 18,43° - 4,4°$ $Q\hat{P}V = 14,03°$	✓subst in tan def/*vervang in tan def* ✓size $\hat{P}$ /*grootte* $\hat{P}$ ✓$18,43° - 4,4°$ ✓$14,03°$ (4)
4.2	$\hat{Q} = 90°$ rad $\perp$ tan In ΔPQV: $\tan 14,03° = \frac{QV}{8\sqrt{10}}$ $QV = 6,32$ $\therefore$ 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]

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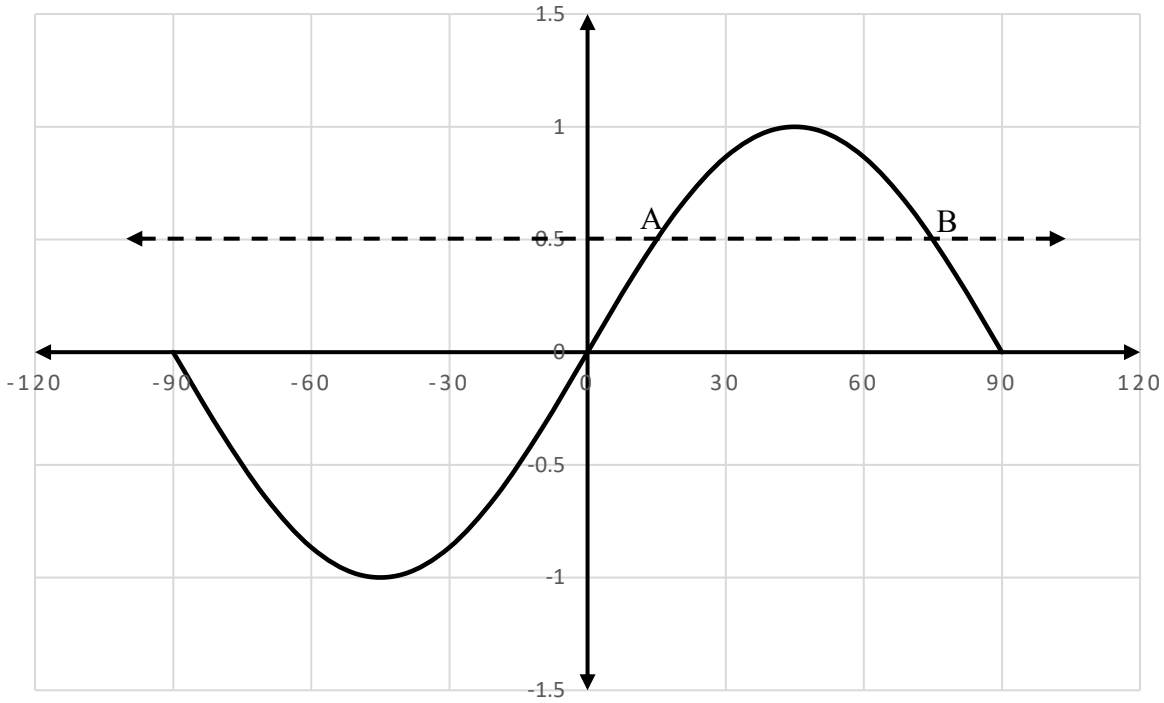
QUESTION/*VRAAG* 5		
5.1.1	$\tan\theta = -\frac{5}{4}$ $r = \sqrt{41}$  $\sin(180° + \theta)$ $= -\sin\theta$ $= \frac{5}{\sqrt{41}}$	✓value r/*waarde r* ✓reduction/*reduksie* ✓answer/*antwoord* (3)
5.1.2	$\sqrt{41}\cos\theta - 4\sin(-150°).\cos 180°$ $= \sqrt{41}\cos\theta + 4\sin 150°(-1)$ $= \sqrt{41}\cos\theta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

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

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

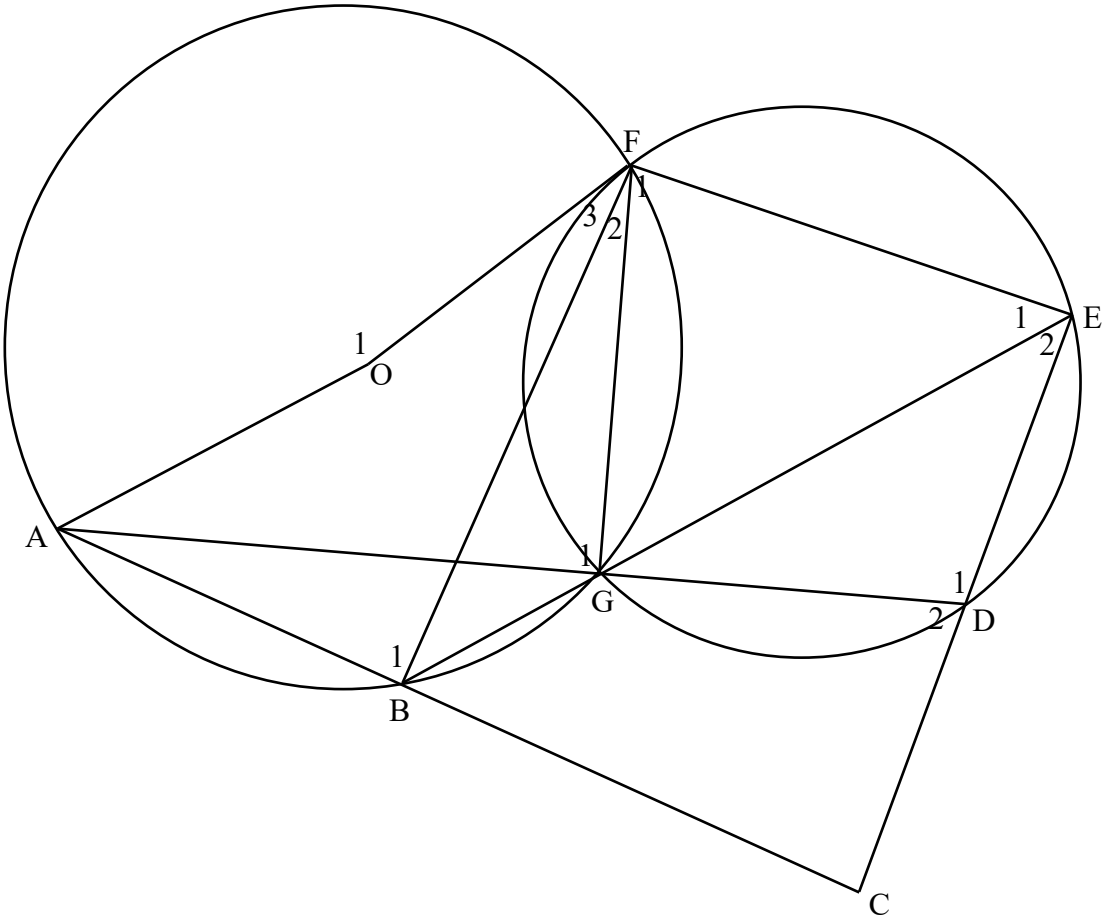
QUESTION/*VRAAG* 7		
7.1.1	$\cos(\alpha-\beta)=\cos\alpha\cos\beta+\sin\alpha\sin\beta$	✓answer/*antwoord* (1)
7.1.2	$\sin 2\alpha$ $=\cos(90°-(\alpha+\alpha))$ $=\cos(90°-\alpha-\alpha)$ $=\cos((90°-\alpha)-\alpha)$ $=\cos(90°-\alpha)\cos\alpha+\sin(90°-\alpha)\sin\alpha$ $=\sin\alpha\cos\alpha+\cos\alpha\sin\alpha$ $=2\sin\alpha\cos\alpha$	✓ $90°-(\alpha+\alpha)$ ✓expansion/*uitbreiding* ✓co-functions/ *ko-funksies* (3)
7.2.1	In ΔPNR : $\sin\theta=\frac{r}{b}$ $r=b\sin\theta$ ……①	✓sin def ✓r subject/*r onderwerp* (2)
7.2.2	$r=b\sin\theta$ ……① $r=a\sin 2\theta$ ……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	$\cos\theta=\frac{\text{PR}}{b}$ PR=$b\cos\theta$ $\cos 2\theta=\frac{\text{PQ}}{a}$ PQ=$a\cos 2\theta$ $\therefore$ QR = PR – PQ $\text{QR}=b\cos\theta-a\cos 2\theta$ $\text{QR}=(2a\cos\theta)\cos\theta-a(2\cos^2\theta-1)$ $\text{QR}=2a\cos^2\theta-2a\cos^2\theta+a$ $\text{QR}=a$	✓ PR=$b\cos\theta$ ✓ PQ=$a\cos 2\theta$ ✓ $\text{QR}=b\cos\theta-a\cos 2\theta$ ✓ substitution/*vervanging* (4)
		[13]

QUESTION/*VRAAG* 8



8.1	$a = 2$	✓ $a = 2$ (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°	✓ $\sin 3x$ ✓ answer/*antwoord* (2)
8.3	$\sqrt{\sin 2x - 1}$ Max/*maks* = 0	✓ answer/*antwoord* (1)
8.4	$f(x) = \sin 2x$ shifted down/*afgeskuif* $\frac{1}{2}$ units/*eenhede* $h(x) = \sin 2x - \frac{1}{2}$	✓ answer/*antwoord* (1)
8.5	$x = 15°$ and/*en* $x = 75°$	✓ $x = 15°$ ✓ $x = 75°$ (2)
		[7]

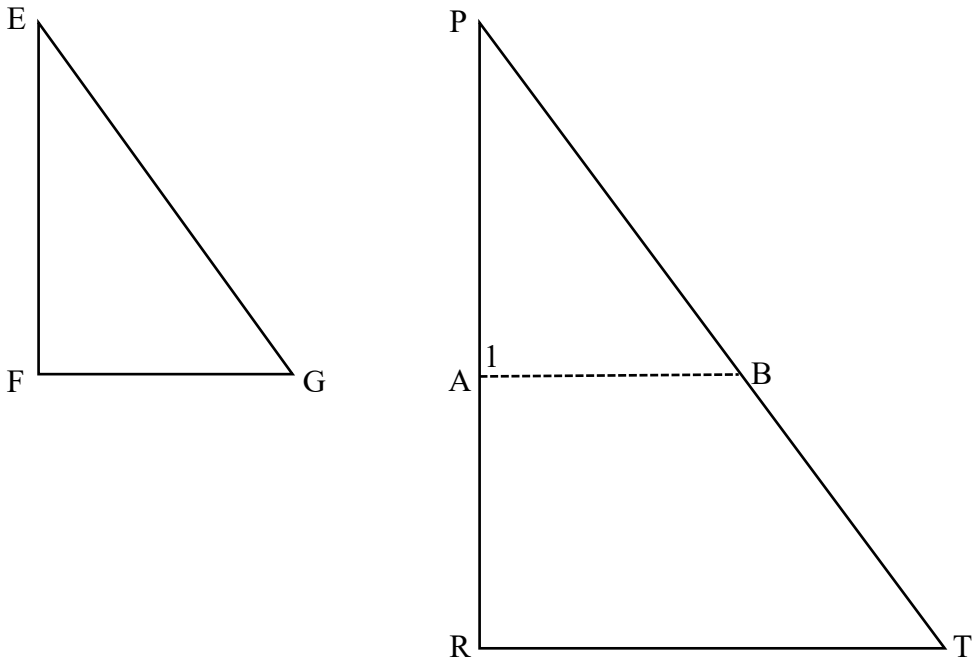
QUESTION/*VRAAG* 9



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

QUESTION/*VRAAG* 10

10.1



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

In ΔEFG and/*en* ΔPAB:

(i) $EF = PA$ constr/*konstr*

(ii) $EG = PB$ constr/*konstr*

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

$\Delta EFG \equiv \Delta PAB$ SAS/*SHS* ✓≡proof/*bewys*

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

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

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

$\therefore AB \parallel RT$ corresp∠'s equal/*ooreenk∠'e gelyk* ✓R

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

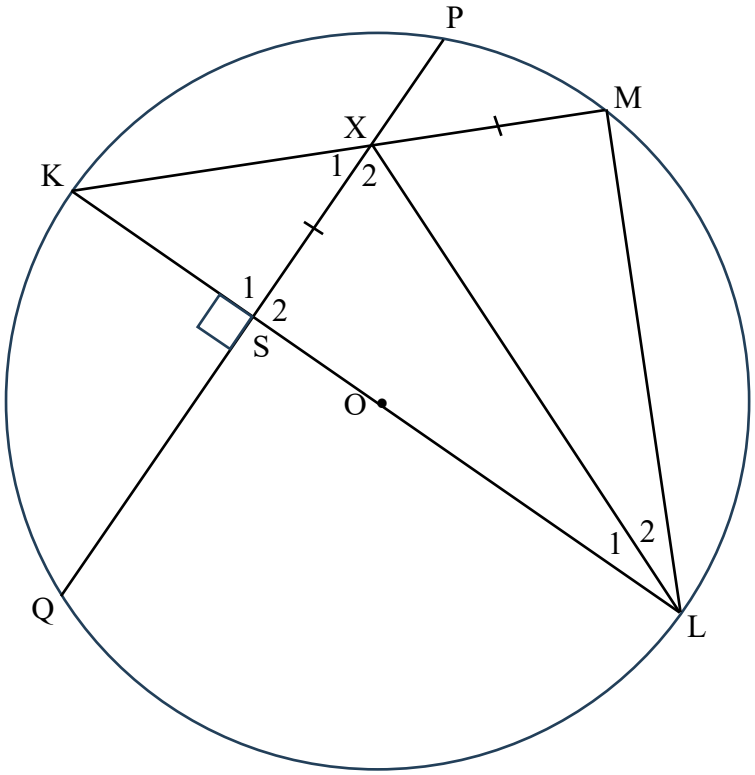
and/*en* $EF = PA$ constr/*konstr* ✓S

$EG = PB$ constr/*konstr*

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

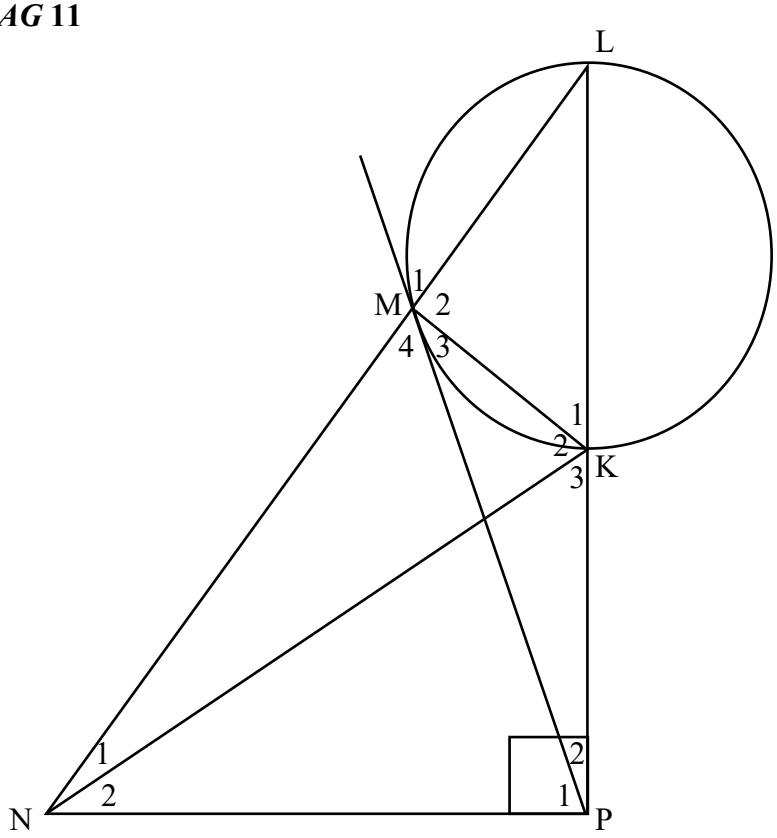
(6)

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10.2		
10.2.1	$\Delta SXL \equiv \Delta MXL$ $\angle\angle S$	✓S (1)
10.2.2 (a)	$KL^2 = KM^2 + ML^2$ Pythagoras $20^2 = KM^2 + 12^2$ $KM^2 = 256$ $KM = 16$	✓S ✓subst/*verv* ✓answer/ *antwoord* (3)
(b)	$\frac{KX}{SX} = \frac{KL}{ML}$ $\|\|\|\Delta$'s $\frac{KX}{SX} = \frac{20}{12} = \frac{5}{3}$ **OR/*OF*** $\frac{KX}{KL} = \frac{SX}{ML}$ $\|\|\|\Delta$'s $\frac{KX}{20} = \frac{SX}{12}$ $\frac{KX}{SX} = \frac{20}{12} = \frac{5}{3}$	✓S ✓R ✓$\frac{5}{3}$ (3) ✓S ✓R ✓$\frac{5}{3}$ (3)

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

QUESTION/*VRAAG* 11



11.1	$\hat{N} = \hat{M}_4$ ∠'s opp equal sides/∠ *'e teenoor gelyke sye* $\hat{M}_4 = \hat{M}_1$ vertically opp ∠'s/*regoorst ∠'e* $\hat{M}_1 = \hat{K}_1$ tan-chord theorem/*rklyn krd stelling* $\therefore \hat{N} = \hat{K}_1$ $\therefore$ KMNP is cyclic quad/*kvh* converse ext∠ cyclic quad/*omg buite ∠ kvh*	✓S/R ✓S ✓S/R ✓R (4)
11.2	$\hat{M}_2 = \hat{P} = 90°$ ext∠ cyclic quad/*buite ∠ kvh* $\therefore$ LK is diameter of the circle chord subtend 90°∠/converse ∠ in semi-circle $\therefore$ *LK is middellyn van die sirkel* *koord onderspan 90°∠/omg ∠ in semi sirkel*	✓S ✓R (2)
11.3	In ΔMKP and/*en* ΔLMP : (i) $\hat{P} = \hat{P}$ common/*gemeensk* (ii) $\hat{M}_3 = \hat{L}$ tan-chord theorem/*rklyn krd stelling* (iii) $M\hat{K}P = L\hat{M}P$ int ∠'s Δ/*binne∠'e Δ* $\therefore \Delta MKP \,|||\, \Delta LMP$ ∠ ∠ ∠	 ✓S ✓S/R ✓S or/*of* ✓R (3)
11.4	$\frac{KP}{MP} = \frac{MP}{LP}$ ||| Δ's $\therefore MP^2 = KP.LP$	✓S/R (1)

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

TOTAL/ *TOTAAL*: 150

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GRADE 12/*GRAAD 12*

MATHEMATICS P2 / *WISKUNDE V2*

SEPTEMBER 2026

MARKING GUIDELINE/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

These marking guidelines consist of 20 pages.
Hierdie nasienriglyne bestaan uit 20 bladsye.

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NOTE:

- If candidate answers a question TWICE, only answer 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 Guideline. Stop marking at the second calculation error.
- Assuming answers/values in order to solve a problem is NOT acceptable

GEOMETRY/MEETKUNDE	
S	**A mark for a correct statement** **(A statement mark is independent of a reason)**
R	**A mark for the correct reason** **(A reason mark may only be awarded if the statement is correct)**
S/R	**Award a mark if statement AND reason are both correct**

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QUESTION 1 / VRAAG 1

Area/Oppervlakte (x) in m^2	360	120	845	602	1190	530	245	486	350	1005	320	250
Time/Tyd (y) in minutes/minute	50	28	130	75	120	95	55	70	48	110	55	60

1.1	$\hat{y} = 0,09x + 28,14$	✓ 0,09 ✓ 28,14 ✓ Answer/Antwoord (3)
1.2	$r = 0,91$	✓ Answer/Antwoord (1)
1.3	Very strong positive / Baie sterk positief	✓ Answer/Antwoord (1)
1.4	$\hat{y} = 0,09(560) + 28,14$ $= 78,54$ $\text{Cost/Koste} = 150 + 3(50)$ $= \text{R}300$	✓Substitution/Substitusie ✓ 78,54 ✓ 3 ✓ R300 (4)

[9]

QUESTION 2 / VRAAG 2

Marks Punte	**Frequency Frekwensie**	**Cumulative frequency Kumulatiewe frekwensie**
$5 < x \leq 15$	4	
$15 < x \leq 25$	7	
$25 < x \leq 35$	m	21
$35 < x \leq 45$	11	
$45 < x \leq 55$	11	
$55 < x \leq 65$	8	
$65 < x \leq 75$	n	
Total	**54**	

2.1

$m = 10$
$n = 3$

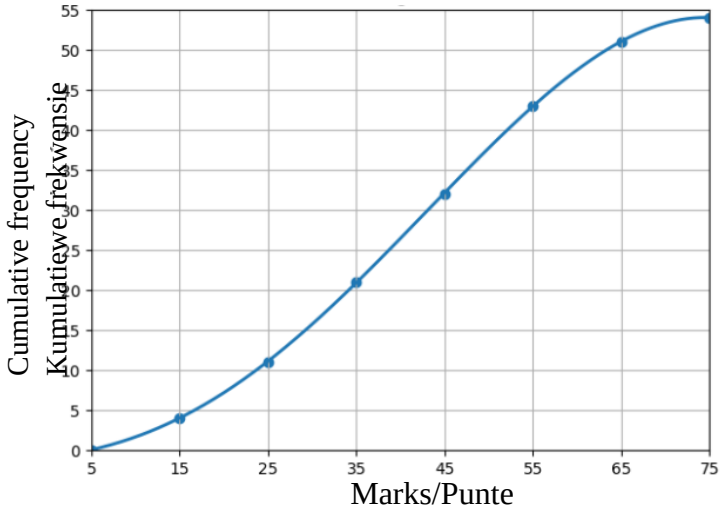
✓ $m = 10$
✓ $n = 3$
(2)

2.2

Marks Punte	Frequency Frekwensie	Cumulative frequency Kumulatiewe frekwensie
$5 < x \leq 15$	4	**4**
$15 < x \leq 25$	7	**11**
$25 < x \leq 35$	**10**	**21**
$35 < x \leq 45$	11	**32**
$45 < x \leq 55$	11	**43**
$55 < x \leq 65$	8	**51**
$65 < x \leq 75$	**3**	**54**
Total/Totaal	**54**	

✓ 1st/e 4 CF/KF
✓ Last/laaste 3 CF/KF
(2)

2.3



✓ Grounded/Gegrond
✓ Plot upper boundaries / Plot boonste grense
✓ Smooth Curve/ Gladde kurwe
(3)

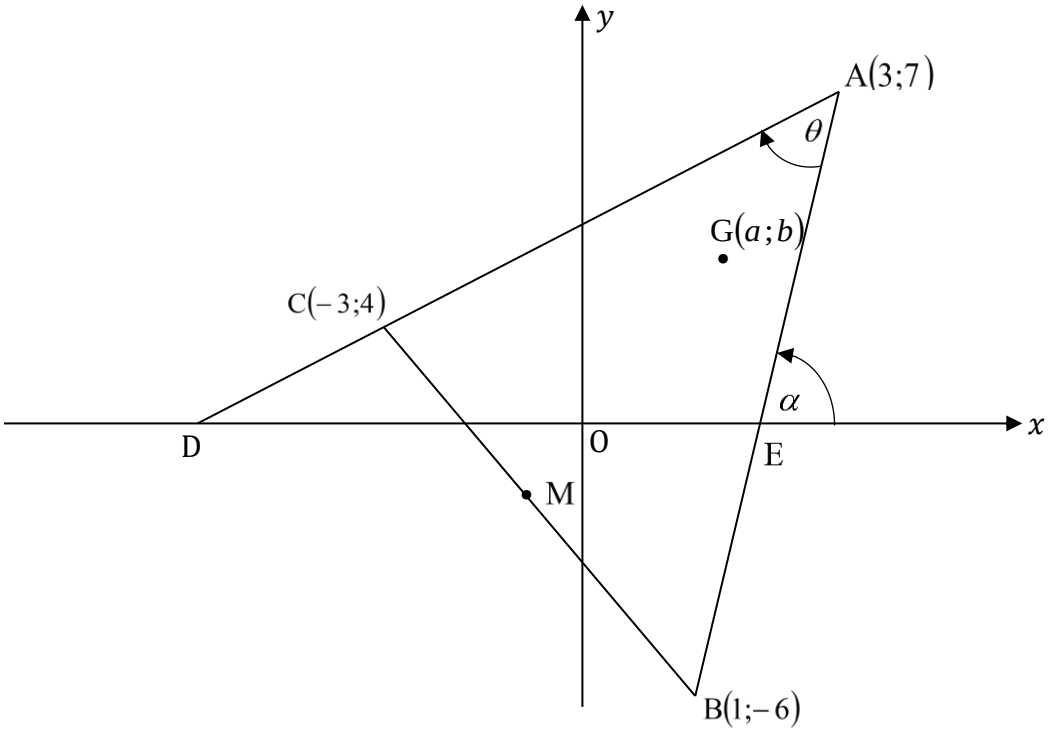
2.4

P_{25} = 27,5 marks / punte

✓ Answer/Antwoord

			(1)
2.5		$\bar{x}$ $= \frac{(10)(4)+(20)(7)+(30)(10)+(40)(11)+(50)(11)+(60)(8)+(70)(3)}{54}$ $= 40$marks/ punte $\sigma = 16{,}33$marks/ punte	✓ Method/ Metode ✓ 40 marks/ punte ✓ 16,33 marks/ punte (3)
			[11]

QUESTION 3 / VRAAG 3

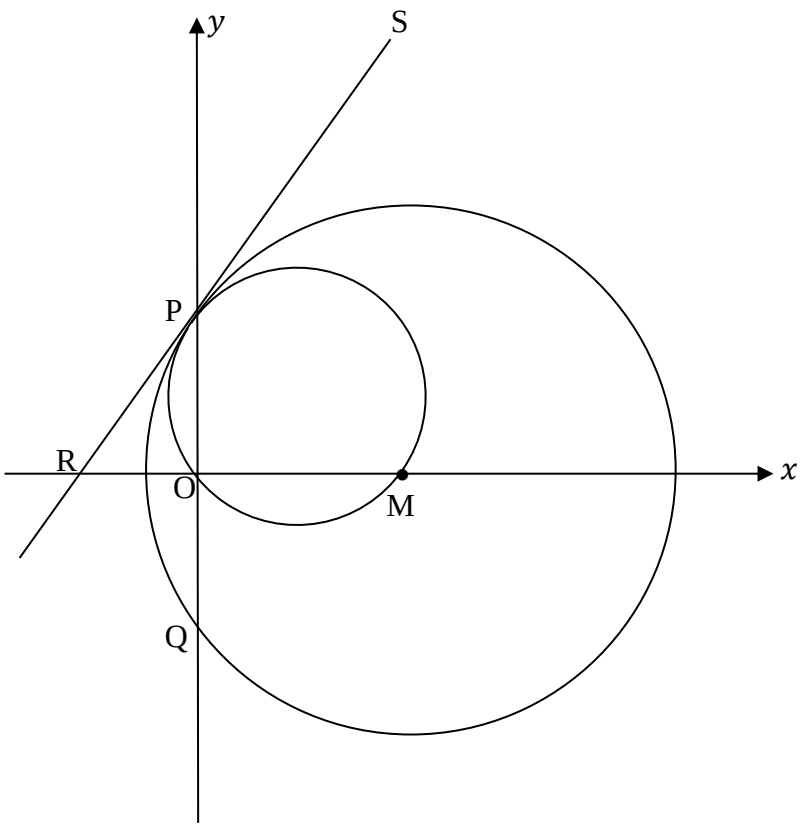


3.1		$m_{AD} = \frac{7-4}{3-(-3)}$ $= \frac{1}{2}$	✓ Substitution/Substitusie ✓ Answer/Antwoord (2)
3.2		$y - 7 = \frac{1}{2}(x-3)$ $\therefore y = \frac{1}{2}x + \frac{11}{2}$	✓ Substitution/Substitusie ✓ Answer /Antwoord (2)
3.3		$y = \frac{1}{2}x + \frac{11}{2}$ $0 = \frac{1}{2}x + \frac{11}{2}$ $x = -11$ $D(-11;0)$ $AD = \sqrt{(3-(-11))^2 + (7-0)^2}$ $= 7\sqrt{5} = 15{,}65$	✓ Substitution/Substitusie ✓ $x = -11$ ✓ Substitution/Substitusie ✓ Answer /Antwoord (4)
3.4		$M\left(\frac{-3+1}{2}; \frac{4-6}{2}\right)$ $M(-1;-1)$	✓ Substitution/Substitusie ✓ Answer/Antwoord (2)

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3.5		$\tan \hat{ADE} = m_{AD} = \frac{1}{2}$ $\hat{ADE} = 26{,}56°$ $m_{AB} = \frac{7-(-6)}{3-1}$ $= \frac{13}{2}$ $\tan \alpha = \frac{13}{2}$ $\alpha = 81{,}25°$ $\theta + 26{,}56° = 81{,}25°$ $\theta = 54{,}69° \approx 55°$	✓ $\hat{ADE} = 26{,}56°$ ✓ Substitution/Substitusie ✓ $m_{AB} = \frac{13}{2}$ ✓ $\alpha = 81{,}25°$ ✓ $\theta = 55°$ (5)
3.6		$m_{AM} = m_{AG}$ $\frac{7-(-1)}{3-(-1)} = \frac{7-b}{3-a}$ $2 = \frac{7-b}{3-a}$ $b = 2a + 1$ $GC^2 = (a-(-3))^2 + (b-4)^2$ $(\sqrt{17})^2 = (a+3)^2 + (2a+1-4)^2$ $17 = a^2 + 6a + 9 + 4a^2 - 12a + 9$ $5a^2 - 6a + 1 = 0$ $(5a-1)(a-1) = 0$ $a = \frac{1}{5}$ or/of $a = 1$ $b = \frac{7}{5}$ or/of $b = 3$	✓ $b = 2a + 1$ ✓ Substitution/Substitusie ✓ Standard form/Standaardvorm ✓ Factors/Faktore ✓ Values/Waardes of/van a ✓ Values/Waardes van b (6)
			[21]

QUESTION 4/ VRAAG 4



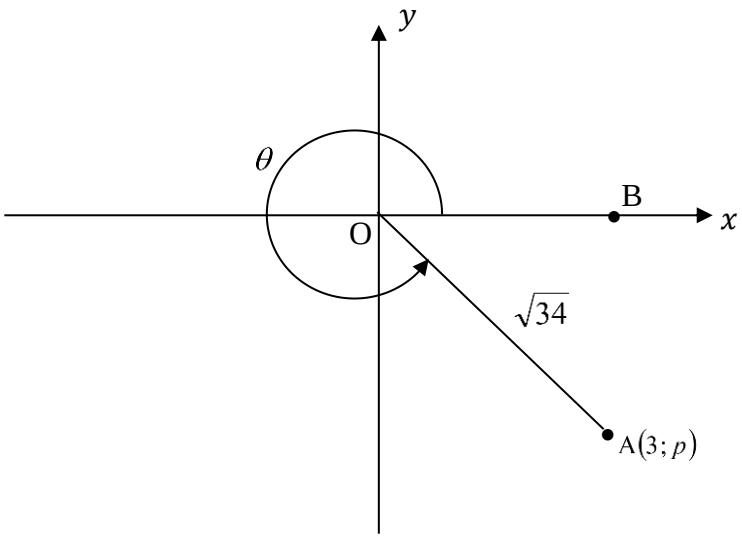
4.1		$x^2-8x+y^2=9$ $x^2-8x+16+y^2=25$ $(x-4)^2+(y-0)^2=25$ $M(4;0)$	✓ $(x-4)^2+y^2=25$ ✓ $M(4;0)$ (2)
4.2		$x^2-8x+y^2=9$ $(0)^2-8(0)+y^2=9$ $y=\pm 3$ $PQ=6$ units / eenhede **OR/OF** $0=\frac{0+x_Q}{2}$; $0=\frac{3+y_Q}{2}$ $Q(0;-3)$ $PQ=6$ units / eenhede	✓ Substitution/Substitusie ✓ Answer/Antwoord (2) **OR/OF** ✓ Substitution/Substitusie ✓ Answer/Antwoord (2)
4.3		$(0-4)^2+y^2=25$ $y^2=9$ $y=3$ $P(0;3)$ $m_{PM}=\frac{0-3}{4-0}=-\frac{3}{4}$	✓ $y=3$ ✓ Substitution/Substitusie ✓ $m_{PM}=-\frac{3}{4}$

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		$m_{tan\,gent/raaklyn} = \frac{4}{3}$ $y = \frac{4}{3}x + 3$	✓ $m_{\text{tangent/raaklyn}} = \frac{4}{3}$ ✓ Answer/Antwoord (5)
4.4		$y = \frac{4}{3}x + 3$ $0 = \frac{4}{3}x + 3$ $x = -\frac{9}{4}$ $\text{R}\left(-\frac{9}{4};0\right)$ $\text{RP}^2 = \left(0-\left(-\frac{9}{4}\right)\right)^2 + (3-0)^2$ $RP^2 = \frac{81}{16} + 9$ $\text{RP}^2 = \frac{225}{16}$ $\text{RP} = \frac{15}{4}$ $\text{Area/Opp of/van } \Delta\text{PRM} = \frac{1}{2}(\text{RP})(\text{PM})$ $= \frac{1}{2}\left(\frac{15}{4}\right)(5)$ $= \frac{75}{8} = 9{,}34$	✓ $x = -\frac{9}{4}$ ✓ Substitution/Substitusie ✓ $\text{RP} = \frac{15}{4}$ ✓ Answer/Antwoord (4)
4.5		$\text{M}_{\text{PM}}\left(\frac{4+0}{2};\frac{3+0}{2}\right)$ $\text{M}_{\text{PM}}\left(2;\frac{3}{2}\right)$ $(0-2)^2 + \left(3-\frac{3}{2}\right)^2 = r^2$ $r^2 = \frac{25}{4}$ $(x-2)^2 + \left(y-\frac{3}{2}\right)^2 = \frac{25}{4}$	✓ $\text{M}_{\text{PM}}\left(2;\frac{3}{2}\right)$ ✓ $(x-2)^2 + \left(y-\frac{3}{2}\right)^2$ ✓ $r^2 = \frac{25}{4}$ (3)
4.6		P, M and P′ are collinear/is koliniêr $P'(4;0)$ $r = 5$ Maximum distance/Maksimum afstand $= 5$units /eenhede	✓ P, M and P′ are collinear/ /is koliniêr ✓ $\text{P}'(4;0)$ ✓ Answer/Antwoord (3)
			[19]

QUESTION 5 / VRAAG 5

5.1	$\cos(P+Q) = \sin[90° - (P+Q)]$ $= \sin[(90° - P) - Q]$ $= \sin(90° - P)\cos Q - \cos(90° - P)\sin Q$ $= \cos P\cos Q - \sin P\sin Q$	✓ $\sin(90° - (P+Q))$ ✓ $\sin((90° - P) - Q)$ ✓ Expansion (3)



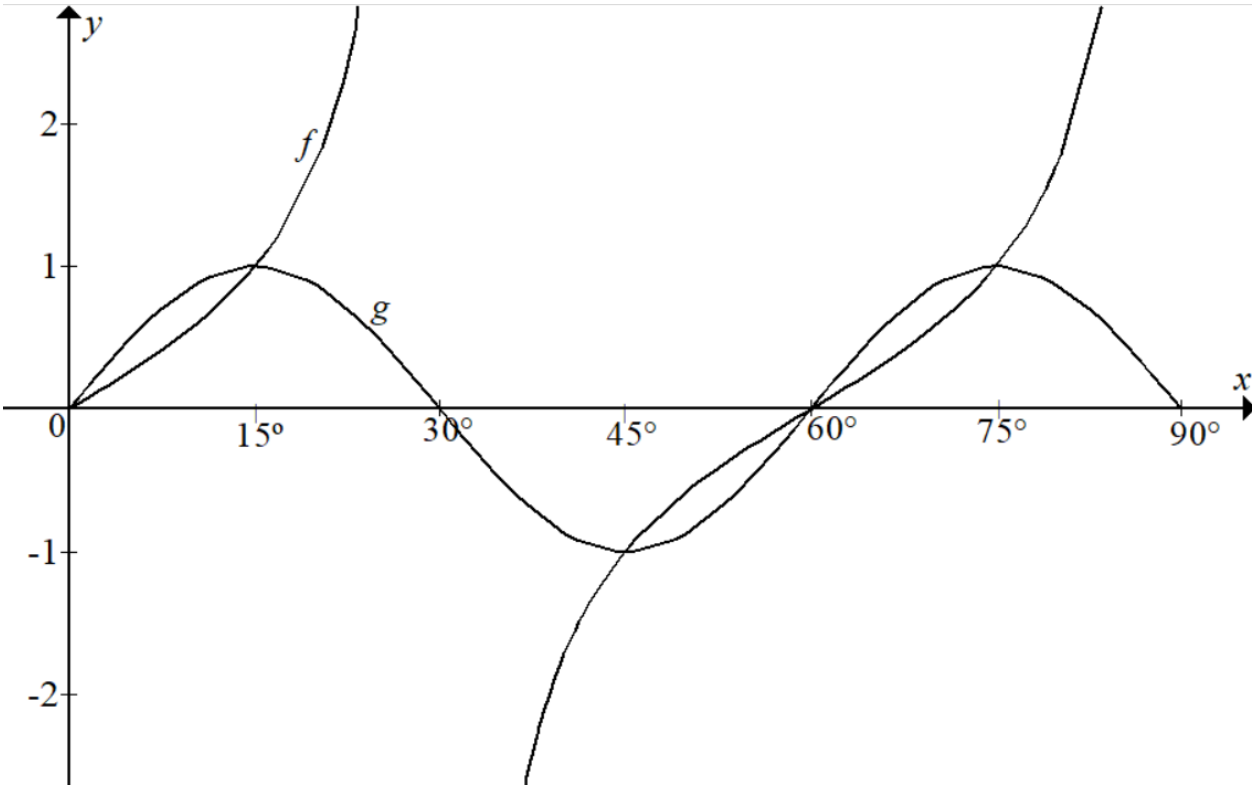
	5.2.1	$(3)^2 + (p)^2 = \left(\sqrt{34}\right)^2$ $p = -5$	✓ Subst. Pyth. ✓ Answer/Antwoord (2)
	5.2.2	$\cos(60° + \theta)$ $= \cos 60°\cos\theta - \sin 60°\sin\theta$ $= \left(\frac{1}{2}\right)\left(\frac{3}{\sqrt{34}}\right) - \left(\frac{\sqrt{3}}{2}\right)\left(\frac{-5}{\sqrt{34}}\right)$ $= \frac{3+5\sqrt{3}}{2\sqrt{34}}$	✓ Expansion/Brei uit ✓ Special Angles/Spesiale hoeke ✓Substitution/Substitusie ✓ Answer/Antwoord (4)
5.3	$\sin 50° = \sin 145°\cos(360° - k) - \sin(-375)\cos(-35)$ $\sin 50° = \sin 35°\cos k - [-\sin 375°\cos 35]$ $\sin 50° = \sin 35°\cos k + \sin 15°\cos 35°$ $\therefore k = 15°$	✓ $\sin 35°$ ✓ $\cos k$ ✓ $\sin 15°$ ✓ $\cos 35°$ ✓ Answer/Antwoord (5)	
5.4	$\text{LHS} = 4\cos\theta - \frac{1+\cos 2\theta}{\cos\theta}$ $= \frac{4\cos^2\theta - (1+\cos 2\theta)}{\cos\theta}$ $= \frac{4\cos^2\theta - 1 - (2\cos^2\theta - 1)}{\cos\theta}$	✓ Single Fraction/Enkel breuk ✓ $2\cos^2\theta - 1$	

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	$= \frac{2\cos^2\theta}{\cos\theta}$ $= 2\cos\theta$ RHS $= \frac{\sin 2\theta}{\sin\theta}$ $= \frac{2\sin\theta\cos\theta}{\sin\theta}$ $= 2\cos\theta$	✓ Simplification/Vereenvoudig ✓ $2\sin\theta\sin$ (4)
5.5	$2\cos x = 3\tan x$ $2\cos x = \frac{3\sin x}{\cos x}$ $2\cos^2 x = 3\sin x$ $2(1-\sin^2 x) = 3\sin x$ $2 - 2\sin^2 x = 3\sin x$ $2\sin^2 x + 3\sin x - 2 = 0$ $(2\sin x - 1)(\sin x + 2) = 0$ $\sin x = \frac{1}{2}$ or $/of$ $\sin x = -2$ Invalid/Ongeldig $x = 30° + k.360°; k \in Z$ or/of $x = 150° + k.360°; k \in Z$	✓ $\frac{3\sin x}{\cos x}$ ✓ $1-\sin^2 x$ ✓ Standard form/Standaard vorm ✓ Equation/Vergelyking ✓ $x = 30°$ or/of $x = 150°$ ✓ $k.360°;\ k \in Z$ (6)
5.6	$\cos 45° = 1 - 2\sin^2 22{,}5°$ $\frac{\sqrt{2}}{2} = 1 - 2\sin^2 22{,}5°$ $\sin^2 22{,}5° = \frac{1-\frac{\sqrt{2}}{2}}{2}$ $= \frac{2-\sqrt{2}}{4}$ $3 - 4\sin^2 22{,}5° = 3 - 4(\frac{2-\sqrt{2}}{4})$ $= 3 - 2 + \sqrt{2}$ $= 1 + \sqrt{2}$ **OR/OF** $\sin^2 22{,}5° = \frac{1-\cos 45°}{2}$ $\sin^2 22{,}5° = \frac{1-\frac{\sqrt{2}}{2}}{2}$ $= \frac{2-\sqrt{2}}{4}$ $3 - 4\sin^2 22{,}5° = 3 - 4\left(\frac{2-\sqrt{2}}{4}\right)$ $= 1 + \sqrt{2}$	✓ $\cos 45° = 1 - 2\sin^2 22{,}5°$ ✓ Special Angle/Spesiale hoek ✓ Substitution/Substitusie ✓ Answer/Antwoord (4) **OR** ✓ $\sin^2 22{,}5° = \frac{1-\cos 45°}{2}$ ✓ Special Angle ✓ Substitution/Substitusie ✓ Answer/Antwoord (4)
		[28]

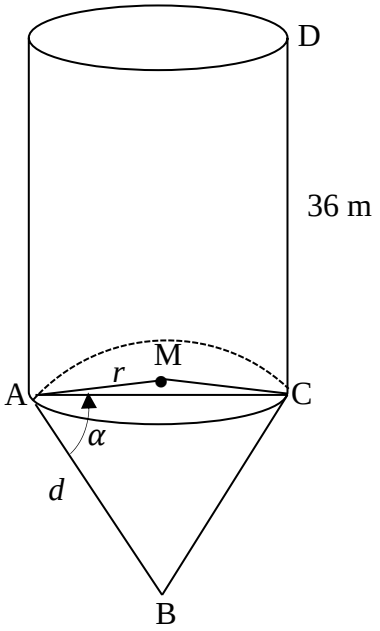
QUESTION 6 / VRAAG 6

6.1



6.1.1	$60°$	✓Answer /Antwoord (1)
6.1.2	$x = 30°$ $x = 90°$	✓ $x = 30°$ ✓ $x = 90°$ (2)
6.1.3	$0° \leq x \leq 15°$ or/of $30° < x \leq 45°$	✓ $0° \leq x \leq 15°$ ✓ $30° < x \leq 45°$ (2)
6.2.1	The graph of $y = sin\,6\,x$ has been translated $10°$ to the right. Die grafiek van $y = sin\,6\,x$ het $10°$ regs geskuif.	✓$10°$ ✓ to the right / regs (2)
6.2.2	$p(x) = -2\sin(6x - 60°) + 1$ $y \in [-2, 2]$ **OR/OF** $-2 \leq y \leq 2$ Range/Waardeversameling: $y \in [-2 + 1\ ;\ 2 + 1]$ $y \in [-1\ ;\ 3]$ **OR/OF** Range/Waardeversameling: $-1 \leq y \leq 3$	✓$y \in [-2\ ;\ 2]$ ✓✓$y \in [-1\ ;\ 3]$ (3)
		[10]

QUESTION 7 / VRAAG 7

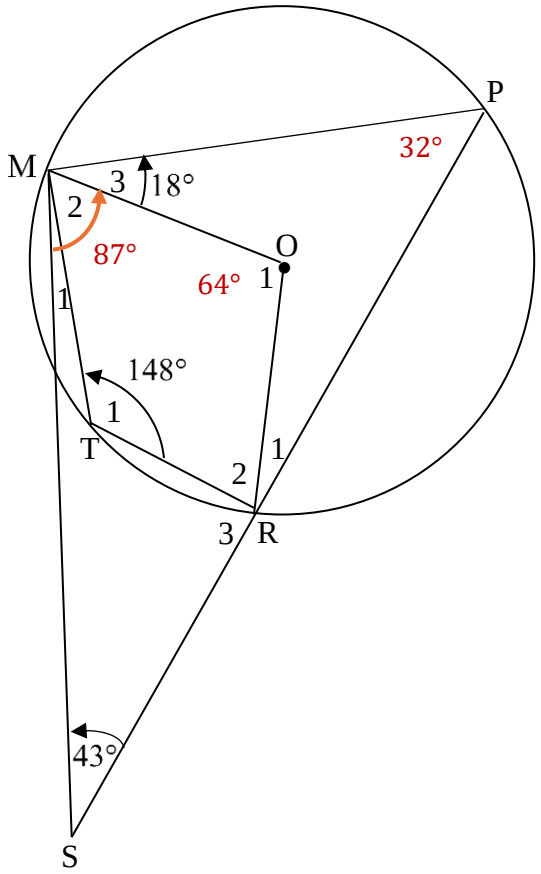


7.1	$AB = BC = d$ | tans from common pt /raaklyne uit dieselfde punt $A\hat{C}B = \alpha$ | $\angle$s opp = sides /$\angle$e teenoor =e sye $\hat{B} = 180° - 2\alpha$ | sum of $\angle$s in Δ/ binne$\angle$e van Δ	✓ $A\hat{C}B = \alpha$ ✓ $\hat{B} = 180° - 2\alpha$ (2)
7.2	$AC^2 = AB^2 + BC^2 - 2AB.BC\cos B$ $AC^2 = d^2 + d^2 - 2d.d\cos(180° - 2\alpha)$ $AC^2 = 2d^2 - 2d^2(-\cos 2\alpha)$ $AC^2 = 2d^2 + 2d^2\cos 2\alpha$ $AC^2 = 2d^2 + 2d^2(2\cos^2\alpha - 1)$ $AC^2 = 4d^2\cos^2\alpha$ $\therefore AC = 2d\cos\alpha$	✓Cosine rule/cosreël ✓ $-\cos 2\alpha$ ✓ $2\cos^2\alpha - 1$ ✓ $AC^2 = 4d^2\cos^2\alpha$ (4)
7.3	*In* ΔACM: $A\hat{M}C = 108°$ | opp$\angle$s of cyclic quad /teenoorst $\angle$e van koordevierhoek $AM = MC = r$ | radii/radiusse $M\hat{A}C = 36°$ | sum of $\angle$s in Δ/ binne $\angle$e van Δ $AC = 2r\cos(M\hat{A}C)$ $12{,}22 = 2r\cos 36°$ $r = \dfrac{12{,}22}{2\cos 36°} = 7{,}55\,m$ **OR/OF**	✓ $A\hat{M}C = 108°$ ✓ $M\hat{A}C = 36°$ ✓ $12{,}22 = 2r\cos 36°$ (3) **OR/OF**

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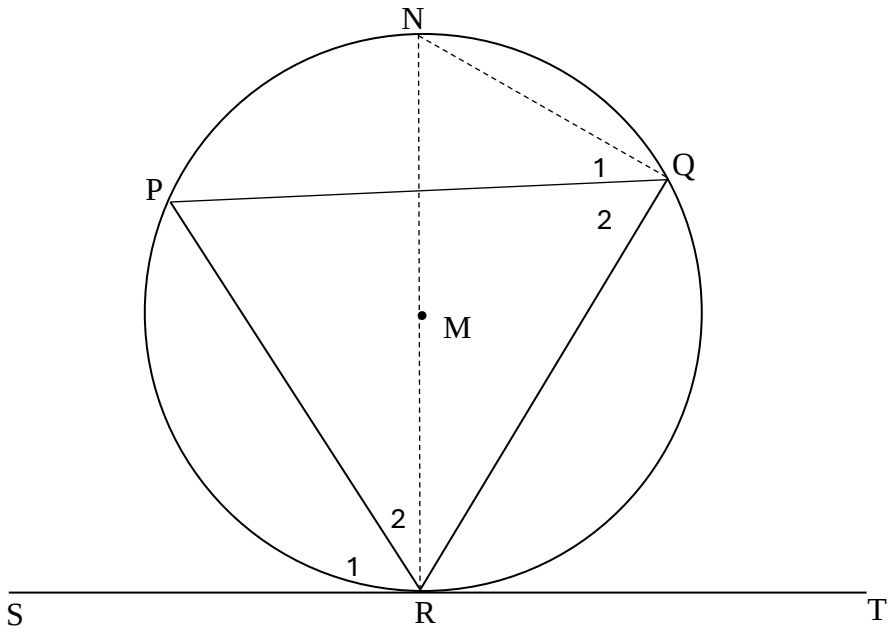
	$A\hat{M}C = 108°$ | opp∠s of cyclic quad / teenoorst ∠e van koordevierhoek $AM = MC = r$ | radii/radiusse $M\hat{A}C = 36°$ | sum of ∠s in Δ / binne ∠e van Δ $\frac{r}{\sin 36°} = \frac{12,22}{\sin 108°}$ $r = \frac{12,22 \sin 36°}{\sin 108°} = 7,5523753425\ 2...$ $\therefore r = 5,55m$ as required/soos gevra. **OR/OF** $A\hat{M}C = 108°$ | opp∠s of cyclic quad / teenoorst ∠e van koordevierhoek $AM = MC = r$ | radii/radiusse $AC^2 = r^2 + r^2 - 2r.r\cos 108°$ $(12,22)^2 = r^2 + r^2 - 2r^2 \cos 108°$ $149,3284 = 2r^2 - 2r^2 \cos 108°$ $r^2(2 - 2\cos 108°) = 149,3284$ $r = \sqrt{\frac{149,3284}{2 - 2\cos 108°}}$ $\therefore r = 7,55m$ as required/soos gevra.	✓ $A\hat{M}C = 108°$ ✓ $M\hat{A}C = 36°$ ✓ $\frac{r}{\sin 36°} = \frac{12,22}{\sin 108°}$ (3) **OR/OF** ✓ $A\hat{M}C = 108°$ ✓Substitution into Cosine Rule /Substitusie in Cos-reël ✓simplification/ vernvoudig (3)
7.4	$V = \pi r^2 h$ $= \pi(7,55)^2(36)$ $= 6446,83m^3$ $= 6\ 447\ m^3$	✓Substitution into correct formula /Substitusie in korrekte formule ✓Answer/Antwoord (2)
		[11]

QUESTION 8 / VRAAG 8



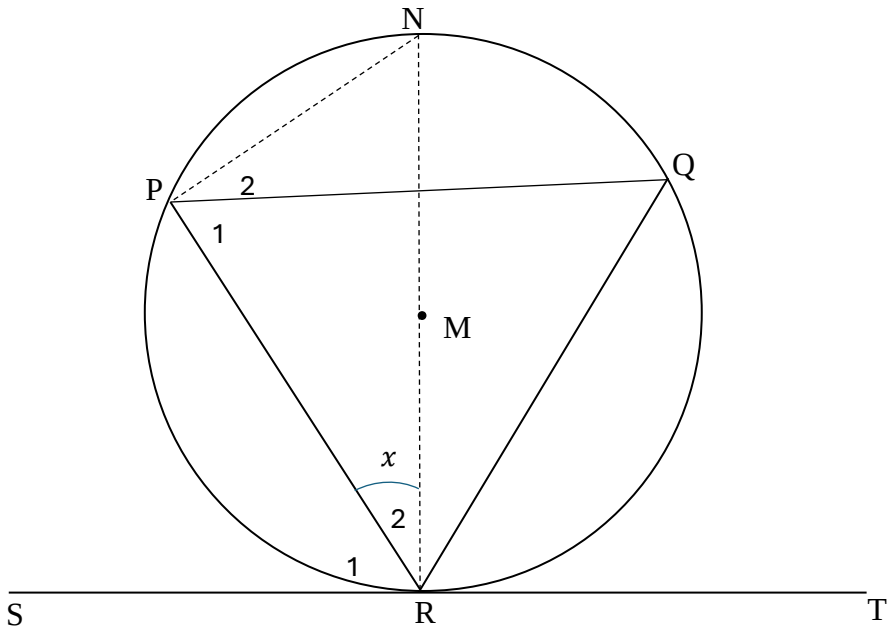
8.1	$\hat{P} = 32°$ | opp ∠s of cyclic quad / teenoorst ∠e van koordevierhoek	✓S ✓R (2)
8.2	$\hat{O}_1 = 2\hat{P}$ $= 64°$ | ∠ at centre = 2∠ at circumference /middelpunts∠ = 2x omtreks∠	✓S ✓R (2)
8.3	$P\hat{M}S + 43° + 32° = 180°$ | sum ∠s of ΔMPS/binne∠e van ΔMPS $P\hat{M}S = 105°$ $\therefore O\hat{M}S = 87°$	✓ $P\hat{M}S = 105°$ ✓ $O\hat{M}S = 87°$ (2)
8.4	$P\hat{M}T = 105° - 6° = 99°$ $\hat{R}_3 = P\hat{M}T = 99°$ | ext ∠ of cyclic quad / buite ∠ van koordevierhoek	✓ $P\hat{M}T = 99°$ ✓S/R (2)
		[8]

QUESTION 9 / VRAAG 9

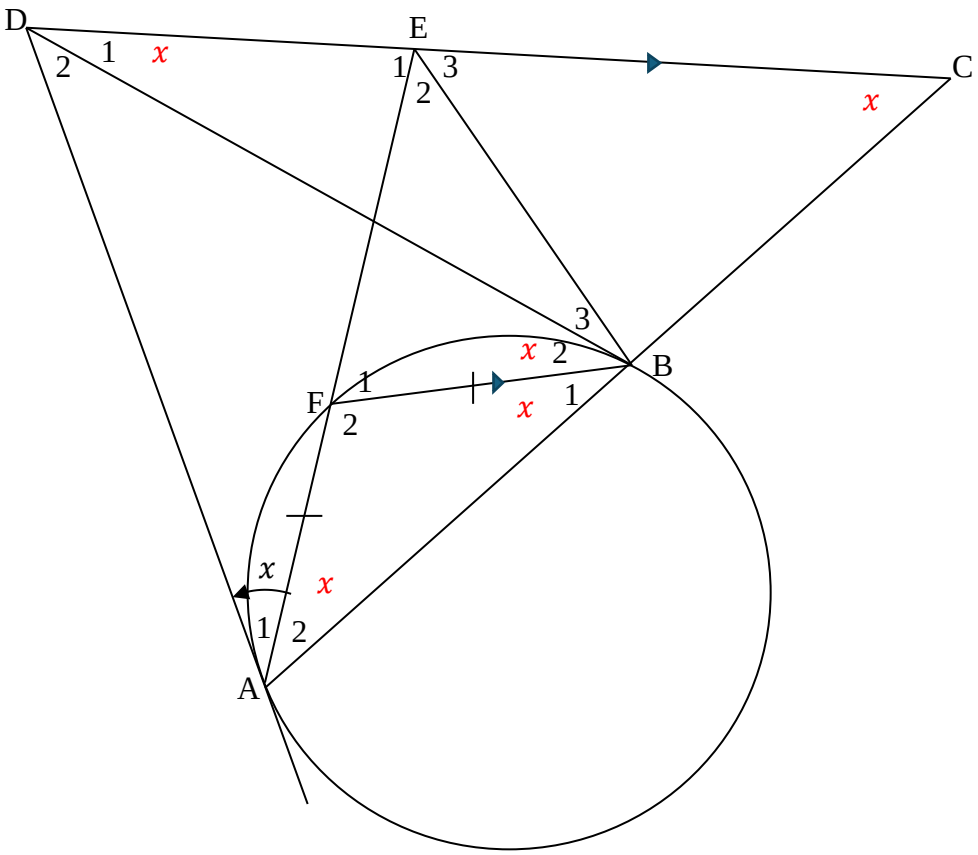


9.1	Construction: Draw diameter RMN and join NQ. Konstruksie: Teken middellyn RMN en verbind NQ. $\hat{R}_1 + \hat{R}_2 = 90°$ | tan $\perp$ radius/ raaklyn $\perp$ radius $\hat{Q}_1 + \hat{Q}_2 = 90°$ | $\angle s$ in the semi-circle / $\angle$e in halfsirkel $\hat{R}_2 = \hat{Q}_1$ | $\angle$s in the same seg/$\angle$e in dieselfde sirkelsegment $\hat{R}_1 + \hat{R}_2 = \hat{Q}_1 + \hat{Q}_2$ | $= 90°$ $\therefore \hat{R}_2 = \hat{Q}_2$ Hence/Vervolgens $P\hat{R}S = P\hat{Q}R$ as required. /soos gevra	✓Construction/Konstruksie ✓S ✓R ✓S/R ✓S/R (5)

QUESTION 9 / VRAAG 9



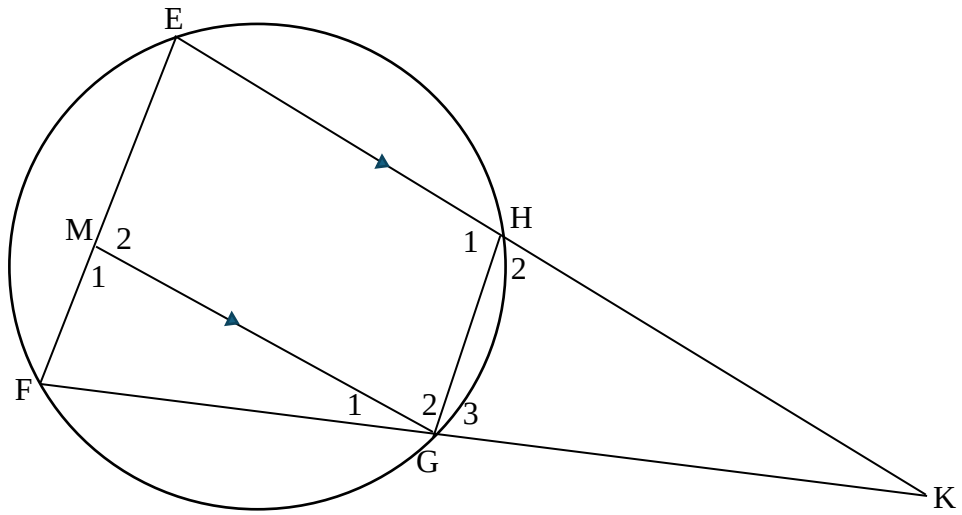
9.1	Construction: Draw diameter RMN and join NP. Konstruksie: Teken middellyn RMN en verbind NP. Let/*Laat* $\hat{R}_2 = x$ $\hat{R}_1 = 90° - x$ | tan $\perp$ radius / raaklyn $\perp$ radius $\hat{N} + N\hat{P}R + \hat{R}_2 = 180°$ | sum of $\angle$s in Δ/ binne$\angle$e van Δ $\hat{N} = 90° - x$ $\hat{Q} = \hat{N}$ | $\angle$s in the same seg/$\angle$e in dieselfde sirkelsegment $\hat{R}_2 = \hat{N}$ | $= 90° - x$ Hence/Vervolgens $P\hat{R}S = P\hat{Q}R$ as required. /soos gevra	✓Construction/Konstruksie ✓S ✓R ✓S/R ✓S/R (5)

9.2		
9.2.1	$\hat{A}_1 = \hat{B}_1 = x$ | tan-chord theorem/raaklyn koord stelling $\hat{A}_2 = \hat{B}_1 = x$ | ∠s opp = sides /∠e teenoor =e sye $\hat{B}_2 = \hat{A}_2 = x$ | tan-chord theorem/ raaklyn koord stelling $\hat{B}_1 = \hat{C} = x$ | corresp∠s /*oo*reenkomstige ∠e, $DC \parallel FB$ $\hat{B}_2 = \hat{D}_1 = x$ | alt∠s/ verwisselende ∠e , $DC \parallel FB$	✓S/R ✓S/R ✓S ✓S ✓R ✓S/R (6)
9.2.2	$\hat{D}_1 = \hat{A}_2$ | proven/ bewys ABED is a cyclic quadrilateral | converse ∠s in the same seg ABED is 'n koordevierhoek | omgekeerde /∠e in dieselfde sirkelsegment.	✓ $\hat{D}_1 = \hat{A}_2$ ✓R (2)
9.2.3	$\hat{A}_1 = \hat{B}_3 = x$ | ∠s in the same seg/∠e in dieselfde sirkelsegment $A\hat{B}E = \hat{B}_1 + \hat{B}_2 + \hat{B}_3$ maar/but $\hat{B}_1 = \hat{B}_2 = \hat{B}_3 = \hat{A}_1 = x$ $\therefore A\hat{B}E = 3\hat{A}_1$	✓S/R ✓S (2)
9.2.4	$\hat{D}_1 = \hat{C} = x$ BC = BD | sides opp = ∠/sye teenoor =e ∠e AD = BD | tans from common pt /raaklyne uit dieselfde punt	✓ $\hat{D}_1 = \hat{C}$ ✓S/R ✓S/R (3)

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	$\therefore AD = BC$ | $= BD$	
9.3	$\frac{AF}{FE} = \frac{AB}{BC} = \frac{2}{3}$ | prop theorem/eweredigheidstelling, FB∥EC $\frac{\text{Area of/van } \Delta FAB}{\text{Area of/van } \Delta EAC} = \frac{\frac{1}{2}AF.AB\ sin\ A_2}{\frac{1}{2}AE.AC\ sin\ A_2}$ $= \frac{\frac{1}{2}(2)(2)\sin A_2}{\frac{1}{2}(5)(5)\sin A_2}$ $= \frac{4}{25}$	✓S ✓ R ✓ $\frac{\frac{1}{2}AF.AB\sin A_2}{\frac{1}{2}AE.AC\sin A_2}$ ✓Answer/Antwoord (4)
		[22]

QUESTION 10 / VRAAG 10



10.1.1	In ΔKGH and/en ΔKEF: $\hat{K} = \hat{K}$ | common/gemeenskaplik $\hat{G}_3 = \hat{E}$ | ext $\angle$ of cyclic quad/buite$\angle$van koordevierhoek $\hat{H}_2 = \hat{F}$ ext $\angle$ of cyclic quad/buite$\angle$van koordevierhoek $\therefore KGH \text{ III } \Delta KEF$ equiangular/AAA//gelykhoekig/HHH	✓S ✓S/R ✓R (3)
10.1.2	$\frac{EF}{GH} = \frac{KE}{KG}$ | III Δs/e $EF.KG = KE.GH$ But $KG = EF$ | given/gegee $\therefore \text{EF}^2 = \text{KE.GH}$	✓ $\frac{EF}{GH} = \frac{KE}{KG}$ ✓R ✓$EF.KG = KE.GH$or/of Substituting/Vervang $KG = EF$ (3)
10.1.3	$\frac{EF}{EM} = \frac{KF}{KG}$ | prop theorem/eweredigheidstelling, $MG \| EK$ $EF.KG = EM.KF$ $\therefore \text{KG}^2 = \text{EM.KF}$	✓ $\frac{EF}{EM} = \frac{KF}{KG}$ ✓$EF.KG = EM.KF$or/of Substituting/Vervang $KG = EF$ (2)
10.2	$KE.GH = EM.KF$ $20 \times 4 = EM \times 16$ $\therefore EM = 5 \text{ units / eenhede}$	✓$KE.GH = EM.KF$ ✓Substitution/Vervanging ✓Answer/Antwoord (3)
		[11]
		TOTAL: 150

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Northern Cape
Department of Education

PROVINCIAL PREPARATORY EXAMINATION/
PROVINSIALE VOORBEREIDENDE EKSAMEN

GRADE 12/*GRAAD 12*

MATHEMATICS/WISKUNDE

PAPER 2/*VRAESTEL 2*

SEPTEMBER 2026

MARKING GUIDELINES/*NASIENRIGLYNE*

***MARKS*/PUNTE: 150**

These marking guidelines consist of 14 pages./
Hierdie nasienriglyne bestaan uit 14 bladsye.

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NOTE:

- If a learner answers a question TWICE, only mark the FIRST attempt.
- If a learner has crossed out (cancelled) an attempt of a question and not redone the question, mark the crossed-out (cancelled) version.
- Consistent accuracy applies in ALL aspects of the marking memorandum.
- Assuming answers/values in order to solve a problem is NOT acceptable.

LET WEL:

- *As 'n leerder 'n vraag TWEE KEER beantwoord, sien slegs die EERSTE poging na.*
- *As 'n leerder 'n poging om die vraag te beantwoord, doodgetrek (gekanselleer) het en nie dit oorgedoen het nie, sien die doodgetrekte (gekanselleerde) poging na.*
- *Volgehoue akkuraatheid word in ALLE aspekte van die nasienmemorandum toegepas.*
- *Aanvaarding van antwoorde/waardes om 'n probleem op te los, word NIE toegelaat nie.*

GEOMETRY/*MEETKUNDE*	
S	A mark for the correct statement (A statement mark 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 a 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 the statement AND reason are both correct. *Ken 'n punt toe as beide die bewering EN rede korrek is.*

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QUESTION 1		
1.1	$a = -5{,}51$ $b = 0{,}85$ $y = -5{,}51 + 0.85x$ • A/O FULL MARKS • CORRECT A/B SWOPPED IN EQUATION 2/3	✓$a = -5{,}51$ ✓$b = 0{,}85$ ✓answer (3)
1.2	$y = -5{,}51 + 0{,}85(113)$ $= 90{,}54$ $= 91$ CA FROM 1.1	✓substitution ✓answer (2)
1.3	$r = 0.897$ $r = 0.90$ The prediction is VALID	✓ value of *r*. ✓valid (2)
1.4	$\tilde{x} + \sigma$ $90.09 + 29.41$ 119.5 *2 learners*	✓90.09 ✓29.41 ✓2 learners (3)
		[10]

QUESTION 2		
2.1	120 learners accurate mark	✓answer (1)
2.2	$Q_1 = \frac{1}{4}(120) = 30$ $Q_3 = \frac{3}{4}(120) = 90$ IQR $= 44 - 26 = 18$ (17-19)	✓44 ✓26 ✓answer (3)
2.3	$Q_2 = \frac{1}{2}(120) = 60$ Q_2=35	✓60 ✓35 (2)
2.4	$120 - 76 = 44$ learners accept 43 – 45	✓method ✓answer (2)
		[8]

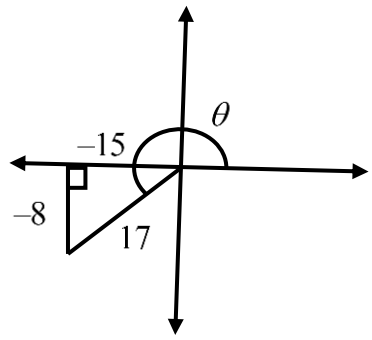
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QUESTION 3		
3.1	$m_{CD}=\frac{12-(-8)}{0-(-5)}$ $m_{CD}=4$ • x/y BD • x swopped in the denominator CA 1/2	✓substitution ✓answer (2)
3.2	$y=4x+c$ $0=4(2.5)+c$ $0=10+c$ $c=-10$ $y=4x-10$	✓gradient ✓substitution ✓answer (3)
3.3	$t=4(6)-10$ $t=14$	✓substitution ✓answer (2)
3.4	$\tan\theta=4$ $\theta=75,96^{\circ}$	✓substitution ✓answer (2)
3.5	$y=4x+12$ $0=4x+12$ $x=-3$ $E(-3\ ;0)$	✓ $y=4x+12$ ✓0 ✓ -3 (3)
3.6	$3y-x=-19$ $3(4x-10)-x=-19$ $12x-30-x=-19$ $11x=11$ $x=1$ $y=4(1)-10$ $y=-6$ $B(1;-6)$	✓substitution ✓simplification ✓ $x=1$ ✓ $y=-6$ (4)

3.7	$m_{EA} = \tan 57{,}26° = 1{,}56$ $y = 1{,}56x + c$ $0 = 1{,}56(-3) + c \quad (-3;0)$ $c = 4{,}67$	✓$m_{EA} = 1{,}56$ ✓ $c = 4{,}67$
	$\text{EA} = \sqrt{(-3-6)^2 + (0-14)^2}$ $= \sqrt{277}$	✓ $\sqrt{277}$
	$\text{Area of } \Delta\text{EAF} = \frac{1}{2}\left(\sqrt{277}\right)(5{,}5)\sin 57{,}26^\circ$ $= 38{,}5 \text{ units}^2$	✓substitution ✓38,5 units
	$\text{Area of } \Delta\text{EOG} = \frac{1}{2}(3)(4{,}67)$ $= 7{,}0 \text{ units}^2$	✓7,0 units^2
	$\text{Area of AGOF} = 38{,}5 - 7{,}0$ $= 31{,}5 \text{ units}^2$	✓answer (7)
	OR	
	$\text{AE} = \sqrt{(-3)-6)^2 + (0-14)^2}$ $= \sqrt{277}$	✓ Length of AE
	$\text{Area of } \Delta\text{AEF} = \frac{1}{2}(\frac{11}{2})(\sqrt{277})\sin 57{,}26°$ $= 38{,}50\,(\text{u})^2$	✓Subs ✓ Area of Δ AEF
	$\tan 57{,}26° = \frac{\text{OG}}{3}$ $\text{OG} = 3\tan 57{,}26°$ $= 4{,}67$	✓ Equation ✓ Length of OG
	$\text{Area of } \Delta\text{EOG} = \frac{1}{2}(3)(4{,}67)$ $= 7{,}005$ $\text{Area of AGOF} = 38{,}50\text{-}7{,}005$ $= 31{,}50\,(\text{u})^2$	✓area of Δ EOG ✓ Answer (7)
		[23]

QUESTION 4		
4.1	$(x+2)^2+(y-6)^2=10+(2)^2+(6)^2$ $(x+2)^2+(y-6)^2=50$ $A(-2;6)$	✓standard form ✓ –2 ✓ 6 (3)
4.2	Line from centre to midpt of chord.	✓answer (1)
4.3	$m=\frac{6-9}{-2-4}=\frac{1}{2}$ $m_{PQ}=-2$ $y=-2x+c$ $9=-2(4)+c$ $9+8=c$ $y=-2x+17$	✓gradient of AB. ✓gradient of PQ. ✓substituion ✓answer (4)
4.4	$x^2+y^2+4x-12y-10=0$ $x^2+(-2x+17)^2+4x-12(-2x+17)-10=0$ $x^2+4x^2-68x+289+4x+24x-204-10=0$ $5x^2-40x+75=0$ $x^2-8x+15=0$ $(x-3)(x-5)=0$ $x=3 \text{ or } x=5$ $y=-2(3)+17 \text{ or } y=-2(5)+17$ $y=11 \text{ or } y=7$ $P(3;11)\ \ Q(5;7)$	✓substituion ✓standard form ✓factors ✓x-values ✓y-values (5)

4.5	$x^2+y^2+4x-12y-10=0$ $x^2+(2x+k)^2-12(2x+k)-10=0$ $x^2+4x^2+4kx+k^2+4x-24x-12k-10=0$ $5x^2+4kx-20x+k^2-12k-10=0$ $\Delta<0$ $(4k-20)^2-4(5)(k^2-12k-10)<0$ $16k^2-160k+400-20k^2+240k+200<0$ $-4k^2+80k+600<0$ $k^2-20k-150>0$ $k=\frac{-(-20)\pm\sqrt{(-20)^2-4(1)(-150)}}{2(1)}$ $k=10-5\sqrt{10}\ \ or\ \ k=10+5\sqrt{10}$ $\therefore k<10-5\sqrt{10}\ \ or\ k>10+5\sqrt{10}$	✓substitution ✓standard form ✓ $\Delta<0$ ✓substitution ✓substitution ✓✓answer (7)
		[20]

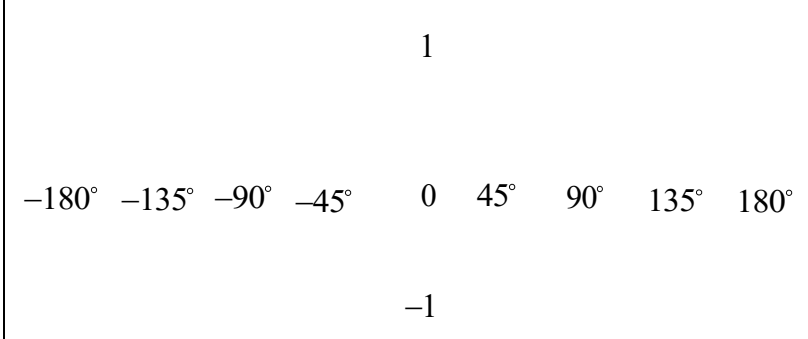
QUESTION 5		
5.1.1	 $\tan\theta=\frac{-8}{-15}=\frac{8}{15}$	✓ $x=-15$ ✓answer (2)
5.1.2	$\cos(180^\circ-\theta)$ $=-\cos\theta$ $=-\left(\frac{-15}{17}\right)$ $=\frac{15}{17}$	✓ $-\cos\theta$ ✓answer (2)

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5.1.3	$\sin\left(\frac{\theta}{2}-15^\circ\right).\cos\left(\frac{\theta}{2}-15^\circ\right)$ $=\frac{1}{2}\sin\left(2.\left(\frac{\theta}{2}-15^\circ\right)\right)$ $=\frac{1}{2}\sin\left(\theta-30^\circ\right)$ $=\frac{1}{2}\left(\sin\theta.\cos 30^\circ-\cos\theta.\sin 30^\circ\right)$ $=\frac{1}{2}\left[\frac{-8}{17}.\frac{\sqrt{3}}{2}-\frac{-15}{17}.\frac{1}{2}\right]$ $=\frac{1}{2}\left[\frac{-8\sqrt{3}+15}{34}\right]$ $=\frac{-8\sqrt{3}+15}{68}$	✓$\frac{1}{2}\left[2\ \sin\left(\frac{\theta}{2}-15°\right)\cos\frac{\theta}{2}-15°\right]$ ✓$\frac{1}{2}\sin\left(2.\left(\frac{\theta}{2}-15^\circ\right)\right)$ ✓$\frac{1}{2}\sin\left(\theta-30^\circ\right)$ ✓expansion ✓substitution ✓answer (6)
5.2.1	$\frac{\tan\left(180^\circ-x\right).\cos\left(-x\right).\cos\left(180^\circ+x\right)}{4\cos\left(90^\circ+x\right)}$ $=\frac{-\tan x.\cos x.\left(-\cos x\right)}{-4\sin x}$ $=\frac{-\frac{\sin x}{\cos x}.\cos x.\left(-\cos x\right)}{-4\sin x}$ $=-\frac{1}{4}\cos x$	✓$-\tan x$ ✓$\cos x$ ✓$-\cos x$ ✓$-4\sin x$ ✓$-\frac{\sin x}{\cos x}$ ✓answer (6)
5.2.2	$x\in(90°;270°)$	✓CV ✓Correct Notation (2)
		[18]

QUESTION 6		
6.1.1	$f(x)=\dfrac{\sin 2x.\cos 2x}{2\sin^2 2x-2\cos^2 2x}$ $=\dfrac{\frac{1}{2}\sin(2.2x)}{-2(\cos^2 2x-\sin^2 2x)}$ $=\dfrac{\frac{1}{2}\sin 4x}{-2\cos 4x}$ $=-\dfrac{1}{4}\tan 4x$	✓$\frac{1}{2}\sin(2.2x)$ ✓ –2 Common factor ✓ $-2\cos 4x$ ✓answer (4)
6.1.2	$x=22.5^\circ \quad x=67,5^\circ$	✓ $x=22.5^\circ$ ✓ $x=67.5^\circ$ (2)
6.2	$\sum_{r=0}^{\infty}(\sin x)^{2r}=2\tan x$ $(\sin x)^{2(0)}+(\sin x)^{2(1)}+(\sin x)^{2(2)}+\ldots\ldots=2\tan x$ $1+\sin^2 x+\sin^4 x+\ldots\ldots=2\tan x$ $a=1 \quad r=\sin^2 x$ $2\tan x=\dfrac{1}{1-\sin^2 x}$ $2\tan x=\dfrac{1}{\cos^2 x}$ $2\dfrac{\sin x}{\cos x}=\dfrac{1}{\cos^2 x}$ $2\sin x\cos^2 x=\cos x$ $2\sin x.\cos^2 x-\cos x=0$ $\cos x(2\sin x\cos x-1)=0$ $\cos x=0 \quad \sin 2x=1$ $2x=90^\circ+k.360^\circ$ $x=45^\circ+k.180^\circ \ ,k\in Z$ **OR**	✓expansion ✓a and r ✓substitution in S_∞ ✓$1-\sin^2 x=\cos^2 x$ ✓standard form ✓both equations ✓ $x=45^\circ+k.180^\circ \ ,k\in Z$ (7)

	$\sum_{r=0}^{\infty}(\sin x)^{2r} = 2\tan x$	
	$(\sin x)^{2(0)} + (\sin x)^{2(1)} + (\sin x)^{2(2)} + \ldots\ldots = 2\tan x$	✓expansion
	$1 + \sin^2 x + \sin^4 x + \ldots\ldots = 2\tan x$	✓a and r
	$a = 1 \quad r = \sin^2 x$	
	$2\tan x = \dfrac{1}{1-\sin^2 x}$	✓substitution
	$2\tan x = \dfrac{1}{\cos^2 x}$	✓$1-\sin^2 x = \cos^2 x$
	$2\dfrac{\sin x}{\cos x} = \dfrac{1}{\cos^2 x}$	
	$LCD = \cos^2 x$	
	$\cos^2 x\left(\dfrac{2\sin x}{\cos x}\right) = \left(\dfrac{1}{\cos^2 x}\right)\cos^2 x$	
	$2\sin x.\cos x = 1$	✓ $2\sin x.\cos x = 1$
	$\sin 2x = 1$	✓ $\sin 2x = 1$
	$2x = 90^\circ + k.360^\circ$	
	$x = 45^\circ + k.180^\circ \ , k \in Z$	✓ $x = 45^\circ + k.180^\circ \ , k \in Z$ (7)
		[13]

QUESTION 7			
7.1	180°	✓answer	(1)
7.2	$y \in \left[\frac{1}{2}; \frac{3}{2}\right]$	✓✓answer	(2)
7.3		✓shape ✓turning points ✓ x-intercepts ✓ y-intercept	(4)
7.4	2	✓✓answer	(2)
7.5	3	✓✓answer	(2)

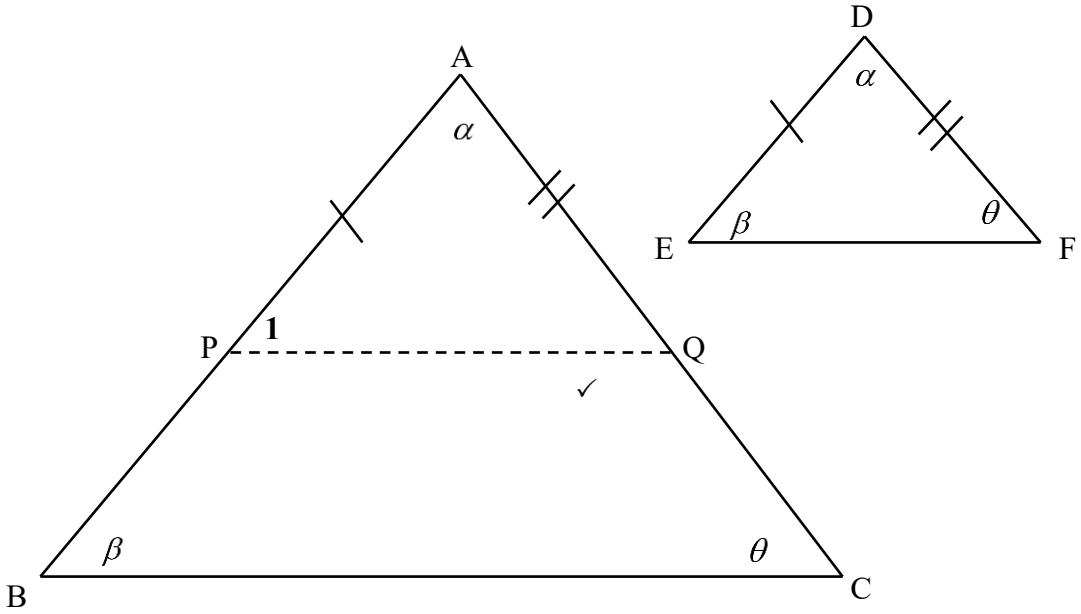
7.6	$\cos(90° + 2x) \,.\, \cos(x - 45°) \geq 0$ $= -\sin 2x \,.\, \cos(x - 45°) \geq 0$ $= [\sin 2x][-\cos(x - 45°)] \geq 0$ $[-180° ; -90°]$ or [-45° ; 0°] or [90° ; 135°]	✓ co-function ✓ $[-180° ; -90°]$ ✓ [-45° ; 0°] ✓ [90° ; 135°] (4)
		[15]

QUESTION 8		
8.1	$Area = \frac{1}{2}(22)(22)\sin 50^\circ$ $= 185,38m^2$	✓correct formula ✓substitution ✓answer (3)
8.2	$AB^2 = (22)^2 + (22)^2 - 2(22)(22)\cos 50^\circ$ $AB = \sqrt{345,78...}$ $= 18,60m$ **OR** $B\hat{A}C = 65°$ $(\angle s\ opp = sides)$ $\frac{AB}{\sin 50°} = \frac{BC}{\sin B\hat{A}C}$ $AB = \frac{22.\sin 50°}{\sin 65°}$ $AB = 18,60\ m$	✓substitution ✓answer ✓substitution ✓answer (2)
8.3	$\cos 25° = \frac{18,60}{DB}$ $DB = \frac{18,60}{\cos 25°}$ $DB = 20,52m$	✓substitution ✓answer (2)
8.4	In ΔBDC $\frac{\sin 58°}{22} = \frac{\sin\hat{C}}{20,52}$ $\sin\hat{C} = \frac{20,52\ sin\ 58°}{22}$ $\hat{C} = 52,28°$ $D\hat{B}C = 180° - 58° - 52,28° = 69,72°$	✓substitution into sine rule. ✓value of $\hat{C}$ ✓answer (3)
		[10]

QUESTION 9		
9.1	QR=RS (Tan from same ext pt) $R\hat{Q}S = \frac{180^\circ - 76^\circ}{2} (\angle s\ opp = sides)$ or (sum $\angle$'s of Δ) $= 52^\circ$	✓ S✓ R ✓ S/R ✓ answer (4)
9.2	$\hat{P} = 52^\circ$ (tan *chord – theorem*)	✓S ✓R (2)
9.3	$Q\hat{T}S = 2(52^\circ) = 104^\circ (\angle\ at\ center = 2\angle$ at circumference)	✓S ✓R (2)
		[8]

QUESTION 10		
10.1	$\frac{TR}{WR} = \frac{QR}{VR}$ (Prop theorem QT $\|\|$ VW) $\frac{TR}{WR} = \frac{5}{3}$	✓S/R ✓answer (2)
10.2	PT=TR $\frac{PU}{UV} = \frac{PT}{TW}$ (Prop theorem QT$\|\|$VW) $\frac{PU}{UV} = \frac{5}{2}$	✓S ✓ S ✓answer (3)
10.3	$\frac{\text{Area of } \Delta PUT}{\text{Area of } \Delta PVW} = \frac{\frac{1}{2}PU.PT\sin\hat{P}}{\frac{1}{2}PV.PW\sin\hat{P}}$ $= \frac{(5x)(5y)}{(7x)(7y)}$ $= \frac{25}{49}$ **NOTE**: If perpendicular heihgt is used, construction must be shown on diagram	✓formula ✓substitution ✓answer (3)
		[8]

QUESTION 11



11.1	In ΔAPQ and ΔDEF $AQ = DF$ [construction/*konstruksie*] $\hat{A} = \hat{D}$ [given/*gegee*] $AP = DE$ [construction/*konstruksie*] $\therefore \Delta APQ \equiv \Delta DEF$ [S∠S] $\hat{P}_1 = \hat{E}$ $\hat{P}_1 = \hat{B}$ [$\hat{E} = \hat{B}$] PQ||BC [corresp ∠'s/*ooreenkomstige* ∠ e] $\frac{AP}{AB} = \frac{AQ}{AC}$ [Prop theorem PQ||BC] But/*maar* $AP = DE$ and/en $AQ = DF$ $\therefore \frac{DE}{AB} = \frac{DF}{AC}$	no construction = 0 ✓construction ✓$\therefore \Delta APQ \equiv \Delta DEF$ [S∠S] ✓$\hat{P}_1 = \hat{E}$ ✓ PQ ‖ BC ✓S/R ✓S (6)
11.2.1	$\hat{M}_1 = \theta$ (tan chord theorem) $\hat{P}_2 = \theta$ (∠s opp = sides) $M\hat{S}P = 180° - 2\theta$	✓S/R ✓S ✓answer (3)
11.2.2	ΔKZS and ΔSRP $\hat{K}_2 = \hat{S}_2$ (alt ∠s SL||KZ) $\hat{S}_1 = \hat{P}_1 = \theta$ (proved) $\hat{Z} = \hat{R}$ (sum of ∠s in Δ) $\Delta KZS \|\|\| \Delta SRP$ (AAA)	✓S/R ✓S ✓R (3)

11.2.3	$\widehat{P}_2 = \theta$ (Vert opp $\angle$s =) PT||SZ (Corresp $\angle$s =) $\frac{KT}{TZ} = \frac{KP}{SP}$ (Prop theorem PT||SZ) $KT = \frac{TZ.KP}{SP}$ $\therefore KT = \frac{TZ.KP}{MS} (SP = MS)$	✓S/R ✓S/R ✓S/R ✓S ✓R (5)
		[17]

TOTAL: 150

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education

Department:
Education
North West Provincial Government
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE/
NASIONALE SENIOR SERTIFIKAAT

GRADE/*GRAAD* 12

MATHEMATICS P2/*WISKUNDE V2*

SEPTEMBER 2026

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

These marking guidelines consist of 20 pages.
Hierdie nasienriglyne bestaan uit 20 bladsye.

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Please turn over/*Blaai om asseblief*

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 in order to solve a problem is NOT acceptable.

LET WEL:

- *As 'n kandidaat 'n vraag TWEE KEER beantwoord, merk slegs die EERSTE poging.*
- *As 'n kandidaat 'n antwoord van 'n vraag doodtrek en nie oordoen nie, merk die doodgetrekte poging.*
- *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.*

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QUESTION/*VRAAG* 1

60	62	63	63	67	68	70
71	73	76	76	77	78	79
79	80	80	80	82	82	84

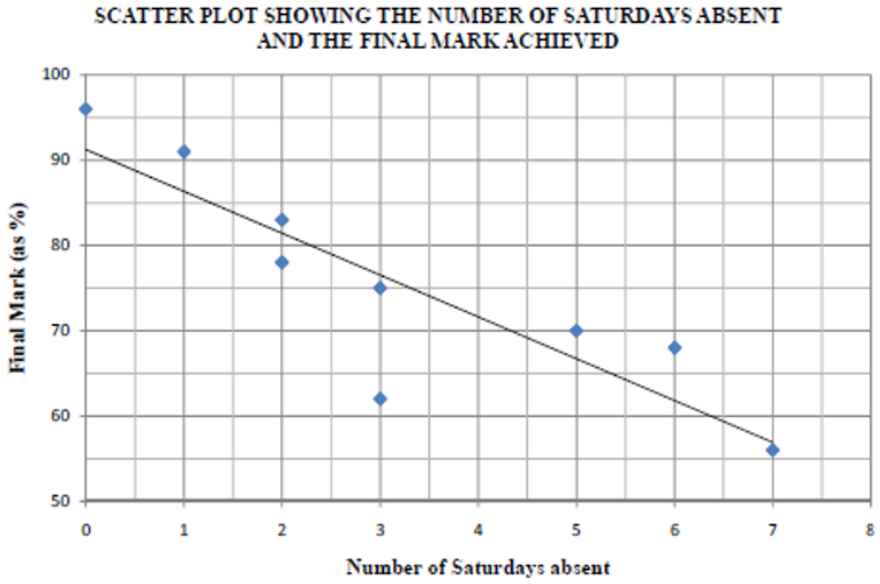
1.1	$\bar{x} = \frac{1550}{21}$ $= 73{,}81$ • Accept/*aanvaar*: 73,74 and 73,8 • Answer only: full marks/ *Slegs antwoord: vol punte*	✓ 1550 ✓answer/*antwoord* (2)
1.2	$Q_2 = 76$	✓ 76 (1)
1.3	$73{,}81 - 76 = -2.52$ • *CA from 1.1 and 1.2* Negative skew OR skew to the left / *Negatief skeef of skeef na links*	✓ Negative skew OR skew to the left / *Negatief skeef of skeef na links* (1)
1.4	$(73{,}81 - 7{,}27 ; 73.81 + 7{,}27)$ $= (66{,}54 ; 81{,}08)$ ≈ 14 *days*	✓ $\sigma = 7{,}27$ ✓ $(66{,}54 ; 81{,}08)$ ✓ answer/*antwoord* (3)
		[7]

- If $\bar{x}$ and σ is swopped/**As $\bar{x}$ en σ omgeruil is** – 2/3
- Wrong $\bar{x}$, wrong σ, /**Verkeerde $\bar{x}$, verkeerde σ, correct answer** – 1/3
- Answer only(ACCURACY) /**Slegs antwoord (AKKURAAT)** - 3/3

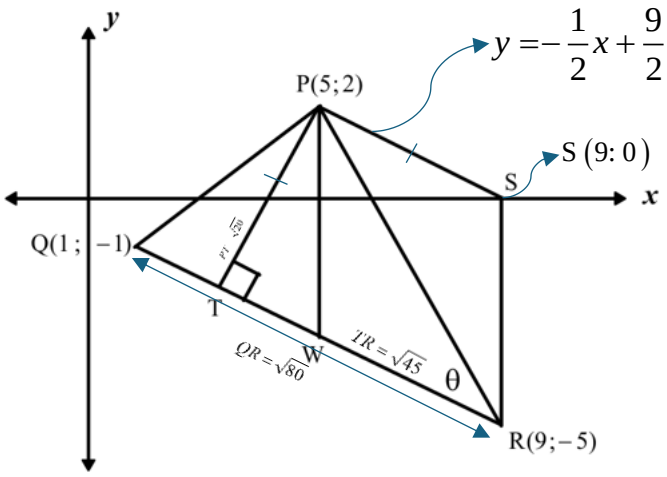
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QUESTION/*VRAAG* 2

Number of Saturdays absent/ *Aantal Saterdae afwesig*	0	1	2	2	3	3	5	6	7
Final mark/ *Finale punt* (as %)	96	91	78	83	75	62	70	68	56

2.1	$a = 91{,}27$ $b = -4{,}91$ $\hat{y} = 91{,}27 - 4{,}91x$	• If *a* and *b* is swopped/**As a en b omgeruil is** – 1/3 • If *a* and *b* is correct but switched in equation/ **As a en b korrek is maar in die vergelyking omgeruil is** – 2/3 • Wrong *a*, wrong *b*, correct equation /**Verkeerde a, verkeerde b, korrekte vergelyking** – 1/3 • Answer only(ACCURACY) /**Slegs antwoord (AKKURAAT)** - 3/3	✓ $a = 91{,}27$ ✓ $b = -4{,}91$ ✓ equation/*vergelyking* (3)
2.2		✓ y-intercept/afsnit ✓ (3.22 ; 75,44)/ Or any correct 2 points (2)
2.3	$r = -0{,}87$	✓ – ✓ 0,87 (2)
2.4	The greater the number of days absent, the lower the mark. / Hoe meer dae afwesig, hoe laer is die punt. **(Answer should be in context with scenario)**	✓ greater nr of days/*meer dae afwesig* ✓lower mark/*laer punt*. (2)
2.5	$\hat{y} = 91{,}27 - 4{,}91(4)$ $= 71{,}63$ Answer only: full marks Slegs antwoord: Vol punte	✓ 4 ✓ 71,63% (2)
		[11]

QUESTION/*VRAAG* 3



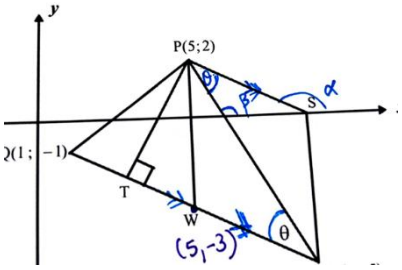
3.1	$m_{QR}=\frac{-1+5}{1-9}$ $=-\frac{1}{2}$	✓ subst./*vervang* ✓ answer/*antwoord* (2)
3.2	$m_{PS}=-\frac{1}{2}$ $(5:2):\ 2=-\frac{1}{2}(5)+c$ $c=\frac{9}{2}$ $\therefore y=-\frac{1}{2}x+\frac{9}{2}$ or / *of* $y-2=-\frac{1}{2}(x-5)$ $y-2=-\frac{1}{2}x+\frac{5}{2}$ $y=-\frac{1}{2}x+\frac{9}{2}$	✓ $m_{PS}=-\frac{1}{2}$ ✓ subst./*vervang* coordinates of/ *koördinate P* ✓ equation/*vergelyking* of PS or/*of* ✓ $m_{PS}=-\frac{1}{2}$ ✓ subst./*vervang* coordinates of/ *koördinate P* ✓ equation/*vergelyking* of PS (3)

3.3	$y=-\frac{1}{2}x+\frac{9}{2}$ $0=-\frac{1}{2}x+\frac{9}{2}$ $x=9$ $S\left(9;0\right)$ CA from 3.2	✓ y = 0 ✓ $x = 9$ (2)
3.4	area / *oppv trapezium* $PQRS=\frac{1}{2}(PS+QR).PT$ $QR=\sqrt{(1-9)^2+(-1-(-5))^2}$ $QR=\sqrt{80}\ /\ 4\sqrt{5}$ $30=\frac{1}{2}\left(\sqrt{20}+\sqrt{80}\right).PT$ $PT=\sqrt{20}\ /\ 2\sqrt{5}$	✓ subst. coordinates in correct formula/*vervang koördinate in korrekte formule* ✓ answer/*antwoord* ✓ subst. distances in correct formula/*vervang afstande in korrekte formule* ✓ answer/*antwoord* (4)

Allow other alternative responses

- Finding the gradient of MR
- Equation of QR
- Equation of PT
- Equate the 2 equations to get the co-ordinates (point of intersection)

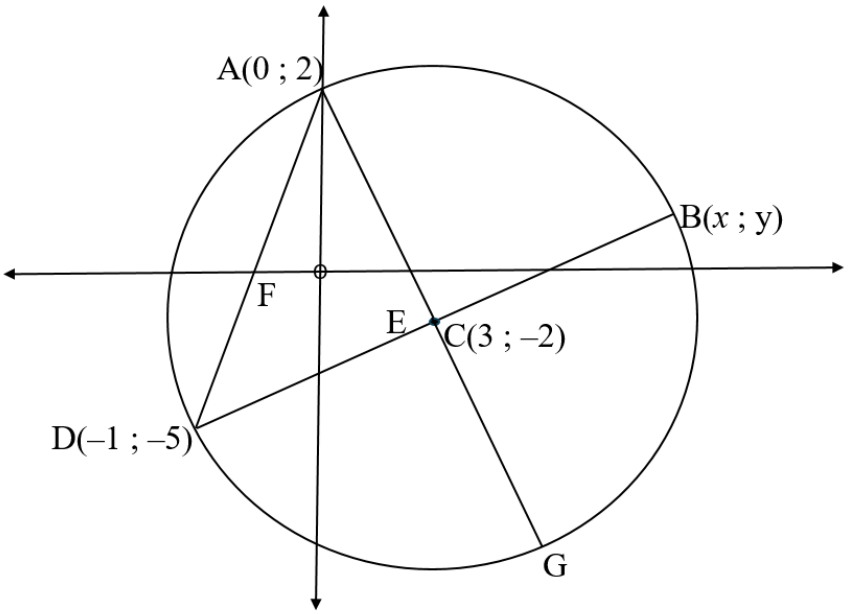
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3.5	$20=(x_T-5)^2+(y_T-2)^2$ ……. (1) $m_{PT}\times m_{QR}=-1$ $\frac{y_T-2}{x_T-5}\times-\frac{1}{2}=-1$ $\frac{y_T-2}{x_T-5}=2$ $\therefore y_T-2=2x-10$ ……. (2) Subst eq 2 into eq 1/*verv verg 2 in verg 1* $20=x^2-10x+25+(2x-10)^2$ $20=x^2-10x+25+4x^2-40x+100$ $0=5x^2-50x+105$ $0=x^2-10x+21$ $0=(x-7)(x-3)$ $\therefore x=7$ *of* $x=3$ *nvt* $T(3;-2)$ Candidates may not ASSUME T is the midpoint… Reward marks only if: • 2 TRIANGLES ARE PROVED TO BE CONGRUENT • If its shown that PQ =PW AND that ΔPQW is an isosceles	✓ subst. distance in correct formula/ *vervang afstande in korrekte formule* ✓ $m_{PT}=\frac{y_T-2}{x_T-5}$ ✓ equation/vergelyking PT ✓ subst./*vervang* PT ✓ std form ✓ answer/*antwoord* (6)
3.6	$PT=\sqrt{20}$ $TR=\sqrt{36+9}=\sqrt{45}$ $\tan\theta=\frac{\sqrt{20}}{\sqrt{45}}$ $\theta=33,69°$ $M_{PR}=-\frac{7}{4}$ $\beta=119,74^\circ$ $M_{PS}=-\frac{1}{2}$ $\alpha=153,43^\circ$ $\theta=153,43^\circ-119,74^\circ\,(\text{ext}<\text{of}\,\Delta)$ $=33,69^\circ\,(alt<,PS//QR)$ 	✓ $TR=\sqrt{36+9}=\sqrt{45}$ ✓ $\tan\theta=\frac{\sqrt{20}}{\sqrt{45}}$ ✓ $\theta=33,69°$ ✓ $\beta=119,74^\circ$ ✓ $153,43^\circ$ ✓ $\theta=33,69°$ (3)

[20]

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QUESTION/*VRAAG* 4



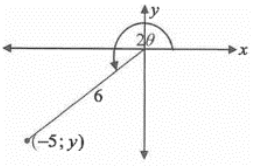
4.1	$3=\frac{-1+x}{2}$ $6=-1+x$ $x=7$ $-2=\frac{-5+y}{2}$ $-4=-5+y$ $y=1$ $\therefore \mathrm{B}(7;1)$	✓subst. coordinates in correct formula/*vervang koördinate in korrekte formule* ✓ $x=7$ ✓subst. coordinates in correct formula/*vervang koördinate in korrekte formule* ✓ $y=1$ (4)
4.2	$\mathrm{AC}^2=(0-3)^2+(2-(-2))^2$ $\mathrm{AC}^2=25$ $\therefore (x-3)^2+(y+2)^2=25$ Or/*of* $DC^2=(-1-3)^2+(-5+2)^2$ $=25$ $\therefore (x-3)^2+(y+2)^2=25$	✓subst. coordinates of/ *vervang koördinate van A and C* ✓ $r^2=25$ ✓ equation/vergelyking ✓subst. coordinates of/ *vervang koördinate van D and C* ✓ $r^2=25$ ✓ equation/vergelyking (3)

4.3	$m_{BD}=\frac{1-(-5)}{7-(-1)}=\frac{3}{4}$ $(3;-2):-2=\frac{3}{4}(3)+c$ $c=-\frac{17}{4}$ $\therefore y=\frac{3}{4}x-\frac{17}{4}\ /\ 4\frac{1}{4}$ OR/*OF* $m_{CD}=\frac{-2-(-5)}{3+1}=\frac{3}{4}$ $y+2=\frac{3}{4}(x-3)$ $y+2=\frac{3}{4}x-\frac{9}{4}$ $y=\frac{3}{4}x-\frac{17}{4}$	✓ m_{BD} ✓ equation/vergelyking (2)
4.4	$m_{AC}=\frac{-2-2}{3-0}$ $=-\frac{4}{3}$ $m_{BC}=\frac{3}{4}$ $m_{AE}\times m_{BC}$ $=-\frac{4}{3}\times\frac{3}{4}$ $=-1$ $\therefore AG\perp BD$ $\hat{A}=90°$ [∠ in semi-circle/∠ *in halwe sirkel*] $\therefore ABGD$ is a square.....diagonals bicect each other ⊥ *AND* $\hat{A}=90°$ / *ABGD is 'n vierkant...* *diagonale halveer mekaar* ⊥ *EN* $\hat{A}=90°$ Or/*Of* ABGD is a square. (diagonals bicest/*diagonal halveer*) $\hat{A}=90°$ [∠ in semi-circle/∠ *in halwe sirkel*] $\therefore ABGD$ *is* a *square* / *vierkant* $AD=5\sqrt{2}$ $AB=5\sqrt{2}$ $\therefore AD=AB$ $\therefore ABGD$ *is* a *square* / *vierkant*	✓ $m_{AC}=-\frac{4}{3}$ ✓ $m_{AE}\times m_{BC}=-1$ ✓ $\therefore m_{ACG}\perp m_{BCD}$ ✓ $D\hat{A}B=90°$ ✓ ABGD is a square. (diagonals bicest at 90° /*diagonale halveer* 90°) ✓ $\hat{A}=90°$ ✓ $AD=5\sqrt{2}$ ✓ $AB=5\sqrt{2}$ (4)

4.5	$m_{BD} = \frac{3}{4}$ $m_{\text{tan } gent} = -\frac{4}{3}$ $(-1;-5): -5 = -\frac{4}{3}(-1) + c$ $c = \frac{31}{3}$ $\therefore y = -\frac{4}{3}x - \frac{19}{3}$ OR/*OF* $y + 5 = -\frac{4}{3}(x+1)$ $y + 5 = -\frac{4}{3}x - \frac{4}{3}$ $y = -\frac{4}{3}x - \frac{19}{3}$	✓ $m_{\text{tan } gent} = -\frac{4}{3}$ ✓ subst. correct coordinate D(-1;-5) /*vervang korrekte koördinate* ✓ equation/vergelyking ✓ $m_{\text{tan } gent} = -\frac{4}{3}$ ✓ subst. correct coordinate D(-1;-5) /*vervang korrekte koördinate* ✓ equation/vergelyking (3)
4.6	$x^2 - 20x + y^2 - 10y + 116 = 0$ $(x-10)^2 + (y-5)^2 = 9$ Centre/*middelpunt*: (10 ; 5) Radius: 3 Distance between centers/*afstand tussen middelpunte*: $\sqrt{(10-3)^2 + (5-(-2))^2} = 7\sqrt{2} \approx 9{,}9$ Sum of radii/*som van radii*: 5 + 3 = 8 Since/*aangesien* 9.9 > 8, the circles **do not intersect**/***sny*** *die sirkels mekaar* ***nie.***	Incorrect std form (follow) up: 5/6 ✓ std form/standard vorm ✓ Centre: (10; 5) ✓ Radius: 3 ✓ Distance between centers = 9,9 ✓ Sum of radii = 8 ✓ answer/*antwoord* (6)

[22]

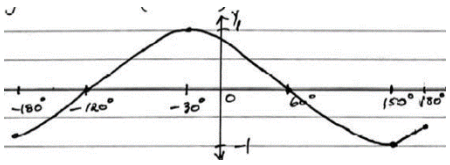
QUESTION/*VRAAG* 5

5.1.1	$\sin 2\theta$  $y^2 = 6^2 - (-5)^2$ $\therefore y = -\sqrt{11}$ CA from diagram $= -\frac{\sqrt{11}}{6}$ Answer only: full marks Slegs antwoord: Vol punte	✓ Diagram in the 3rd quadrant/*3de kwadrant* ✓ $y = -\sqrt{11}$ ✓ $-\frac{\sqrt{11}}{6}$ answer/*antwoord* (3)
5.1.2	$\sin^2\theta$ $\cos 2\theta = 1 - 2\sin^2\theta$ $-\frac{5}{6} = 1 - 2\sin^2\theta$ CA the value of y $-\frac{11}{6} = 1 - 2\sin^2\theta$ $\sin^2\theta = \frac{11}{12}$	✓ $1 - 2\sin^2\theta$ ✓ subst/*vervang* $-\frac{5}{6}$ ✓ $\frac{11}{12}$ (3)
5.2	$\sin(A+B) = \cos[90° - (A+B)]$ $= \cos[(90° - A) - B]$ $= \cos(90° - A)\cos B + \sin(90° - A)\ \sin B$ $= \sin A\cos B + \cos A\sin B$	✓ $\cos[90° - (A+B)]$ ✓ $\cos[(90° - A) - B]$ ✓ $\cos(90° - A)\cos B + \sin(90° - A)\ \sin B$ ✓ $\sin A\cos B + \cos A\sin B$ (4)
5.3	$\frac{\cos(90° + x).\sin(x - 180°) - \cos^2(180° - x)}{\cos(-2x)}$ $= \frac{(-\sin x)(-\sin x) - (-\cos x)^2}{\cos 2x}$ $= \frac{\sin^2 x - \cos^2 x}{(\cos^2 x - \sin^2 x)}$ $= \frac{-(\cos^2 x - \sin^2 x)}{\cos^2 x - \sin^2 x}$ $= -1$	✓ $(-\sin x)$ ✓ $(-\sin x)$ ✓ $(-\cos x)^2$ ✓ $\cos 2x = (\cos^2 x - \sin^2 x)$ ✓ nominator: $-(\cos^2 x - \sin^2 x)$ ✓ –1 (6)

- Reductions of trig identities are independent marks
- $(\cos x)^2$ is also accepted but encourage candidates to show the full reduction before arriving at $(\cos x)^2$.
- Alternative expansion of $\cos 2x$ must lead to the answer to get the mark for expansion

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5.4.1	$LHS = \frac{\sin^2\theta - 2\sin\theta\cos\theta + \cos^2\theta}{\cos^2\theta}$ $= \frac{1-2\sin\theta\cos\theta}{\cos^2\theta}$ $RHS = \frac{1}{\cos^2\theta} - \frac{2\sin\theta}{\cos\theta}$ $= \frac{1-2\sin\theta\cos\theta}{\cos^2\theta}$ $LHS = RHS$ OR/*OF* $\frac{(\sin\theta - \cos\theta)^2}{1-\sin^2\theta} = \frac{1}{\cos^2\theta} - 2\tan\theta$ $LHS = \frac{(\sin\theta - \cos\theta)^2}{1-\sin^2\theta}$ $= \frac{\sin^2\theta - 2\sin\theta\cos\theta + \cos^2\theta}{\cos^2\theta}$ $= \frac{1-2\sin\theta\cos\theta}{\cos^2\theta}$ $= \frac{1}{\cos^2\theta} - \frac{2\sin\theta\cos\theta}{\cos^2\theta}$ $= \frac{1}{\cos^2\theta} - \frac{2\sin\theta}{\cos\theta}$ $RHS = \frac{1}{\cos^2\theta} - 2\tan\theta$	✓ $\sin^2\theta - 2\sin\theta\cos\theta + \cos^2\theta$ ✓ $\sin^2\theta + \cos^2\theta = 1$ ✓ $\cos^2\theta$ ✓ $\tan\theta = \frac{\sin\theta}{\cos\theta}$ ✓ $\frac{1-2\sin\theta\cos\theta}{\cos^2\theta}$ ✓ $\sin^2\theta - 2\sin\theta\cos\theta + \cos^2\theta$ ✓ $\sin^2\theta + \cos^2\theta = 1$ ✓ $\cos^2\theta$ ✓ $\frac{1}{\cos^2\theta} - \frac{2\sin\theta\cos\theta}{\cos^2\theta}$ ✓ $\frac{2\sin\theta}{\cos\theta}$ (5)

5.4.2	$1-\sin^2\theta=0$ OR / *OF* $\cos^2\theta=0$ $\theta=90°;270°$ $\therefore\theta=90°;270°$ Answer only: full marks Slegs antwoord: Vol punte	✓ $1-\sin^2\theta=0$ or / *of* $\cos^2\theta=0$ ✓ $\theta=90°;270°$ (2)
5.5	$k(x)=\sin 60°\cos x+\cos 60°\sin x$ $=\sin(60°+x)$ OR/OF $k(x)=\cos 30°\cos x+\sin 30°\sin x$ $=\cos(30°-x)$ $y\in[-1;1]$ OR $-1\le y\le 1$  	(Reverse special angle id) ✓ $\sin(60°+x)$ or / *of* $\cos(30°-x)$ ✓ $y\in[-1;1]$ (2)

[25]

QUESTION/*VRAAG* 6

6.1	720°	✓ answer/*antwoord* (1)
6.2	$AB=\cos\frac{\alpha}{2}-\cos(\alpha-30°)$ *at* $\alpha=150°$ $AB=\cos 75°-\cos 120°$ $=0,76$ Answer only: full marks Slegs antwoord: Vol punte	✓ $\cos 75°-\cos 120°$ (or substitution of angles/verv grade) ✓ answer/*antwoord* (2)
6.3	$f(\alpha)-g(\alpha)=0$ $\therefore\quad f(\alpha)=g(\alpha)$ $\cos\frac{\alpha}{2}=\cos(\alpha-30°)$ $\frac{\alpha}{2}=\alpha-30°$ Answer only [Calculator usage] will not be ACCEPTED to find "specific solutions" in this case, candidates must apply the skill of general solution to determine specific solution with respect to the given interval. $\frac{\alpha}{2}=\alpha-30°+k.360°$ $\quad\frac{\alpha}{2}=360°-(\alpha-30°)+k.360°$ $\alpha=2\alpha-60°+k.720°$ $\quad\frac{\alpha}{2}=360°-\alpha+30°+k.360°$ $-\alpha=-60°+k.720°$ $\quad\frac{3\alpha}{2}=390°-\alpha+k.360°$ $\alpha=60°+k.720°$ $\quad\alpha=260°+k.240°$ $k\in\mathbb{Z}$ $\therefore\alpha=20°;60°;260°$ Answer only: 1/6	✓ $\cos\frac{\alpha}{2}=\cos(\theta-30°)$ ✓ $\frac{\alpha}{2}=\alpha-30°+k.360°$ ✓ $\frac{\alpha}{2}=360°-(\alpha-30°)+k.360°$ ✓ $\alpha=60°+k.720°$ & ✓ $\alpha=260°+k.240°$ ✓ $\alpha=20°;60°;260°$ together with $k\in\mathbb{Z}$ (6)

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6.4	$[-180°;20°)$ CA from diagram	✓ values/*waardes* ✓ notation/*notasie* (2)
6.5	$h(\alpha)=-\cos(\alpha-30°+30°)$ $h(\alpha)=-\cos(\alpha)$ Answer only: full marks Slegs antwoord: Vol punte	✓ $+30°$ ✓ $h(\alpha)=-\cos(\alpha)$ (2)
6.6	$\alpha=0°\therefore\cos\frac{\alpha}{2}=1$ $\alpha=180°\therefore\cos\frac{\alpha}{2}=0$ $\alpha=360°\therefore\cos\frac{\alpha}{2}=-1$ $\sum_{\alpha=0°}^{k}=0$ if/*as* k = 360° Answer only: full marks Slegs antwoord: Vol punte	✓ $\alpha=0°$ ✓ answer/*antwoord* (2)

[15]

QUESTION/*VRAAG* 7

7.1.1	$P\hat{S}Q=90°$ ..... $\angle^s$ *in a semi – circle / sirkel* $RQS=90°+\theta$ ..... *ext* $\angle$ of Δ / *buite* $\angle$ Δ	✓ $P\hat{S}Q=90°$ ✓ R (2)
7.1.2	$RS^2=QR^2+QS^2-2(QR)(QS)\cos\hat{Q}_2$ $RS^2=(2x)^2+x^2-2(2x)(x)\cos(90°+\theta)$ $RS^2=4x^2+x^2+4x^2\sin\theta$ $RS^2=5x^2+4x^2\sin\theta$ $RS^2=x^2(5+4\sin\theta)$ If QR is $\frac{x}{2}$ and QS = x $RS^2=(\frac{x}{2})^2+x^2-2(\frac{x}{2})(x)\cos(90°+\theta)$ $RS^2=(\frac{x}{2})^2+x^2-2(\frac{x}{2})(x)[-\sin\theta]$ $RS^2=\frac{x^2}{4}+x^2+x^2\sin\theta$ $RS^2=\frac{5x^2}{4}+x^2\sin\theta$ $RS^2=x^2(\frac{5}{4}+\sin\theta)$	✓ correct subst of cosine rule *korrekte subst in die cosinus-reël* ✓ $-\sin\theta$ (can be implied) ✓ x^2 (comm factor / *gem faktor*) ✓ correct subst of cosine rule *korrekte subst in die cosinus-reël* ✓ $-\sin\theta$ (can be implied) ✓ x^2 (comm factor / *gem faktor*) (3)

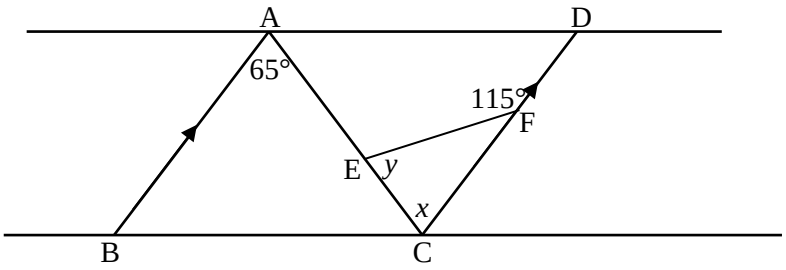
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7.2	$A=\frac{1}{2}(QR)(QS)\sin(90°+\theta)$ $=\frac{1}{2}\times(2\times 2)(2)\times\cos 30°$ $=4\times\frac{\sqrt{3}}{2}$ $=2\sqrt{3}$ units^2 / *eenhede*^{2} If QR is $\frac{x}{2}$ and QS = x If QR is $\frac{x}{2}$ and QS = x $A=\frac{1}{2}(QR)(QS)\sin(90°+\theta)$ $=\frac{1}{2}\times\left(\frac{x}{2}\right)(x)\times\cos 30°$ $=\frac{1}{2}\times\left(\frac{2}{2}\right)(2)\times\cos 30°$ $=\frac{\sqrt{3}}{2}$ $=\sqrt{3}$ units^2 / *eenhede*^{2}	✓ Setting up area rule/*Instel van oppervlakte-reël* ✓ correct subst of area rule/ *korrekte subst in die oppervlakte-reël* ✓ $\cos 30°$ ✓ answer/*antwoord* ✓ Setting up area rule/*Instel van oppervlakte-reël* ✓ correct subst of area rule/ *korrekte subst in die oppervlakte-reël* ✓ $\cos 30°$ ✓ answer/*antwoord* (4)

[9]

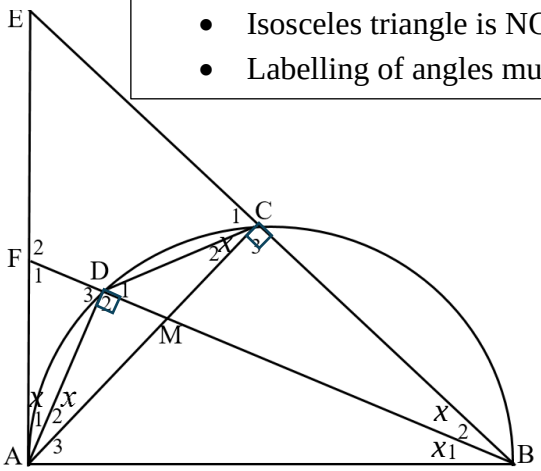
GEOMETRY/*MEETKUNDE*

Please read carefully through the following table before marking **QUESTION 8–10**/
*Lees asseblief sorgvuldig deur die volgende tabel alvorens **VRAE 8–10** nagesien word.*

	The order in which the candidate answers a geometry question must follow logically/ *Die volgorde waarin 'n kandidaat 'n meetkundevraag beantwoord moet logies volg.* **Example/*Voorbeeld*** Given/*Gegee* AB || CD and/*en* $E\hat{F}D = 115°$  The candidate first needs to calculate *x* BEFORE he/she can calculate *y/Die kandidaat moet eerste vir x bereken VOORDAT hy/sy vir y kan bereken.*
S	A mark for a correct statement (A statement mark 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 the statement AND reason are both correct (Both MUST be correct to get one mark)
	Ken 'n punt toe as die bewering EN rede beide korrek is *(Beide MOET korrek wees om een punt te kry)*

QUESTION/*VRAAG* 8

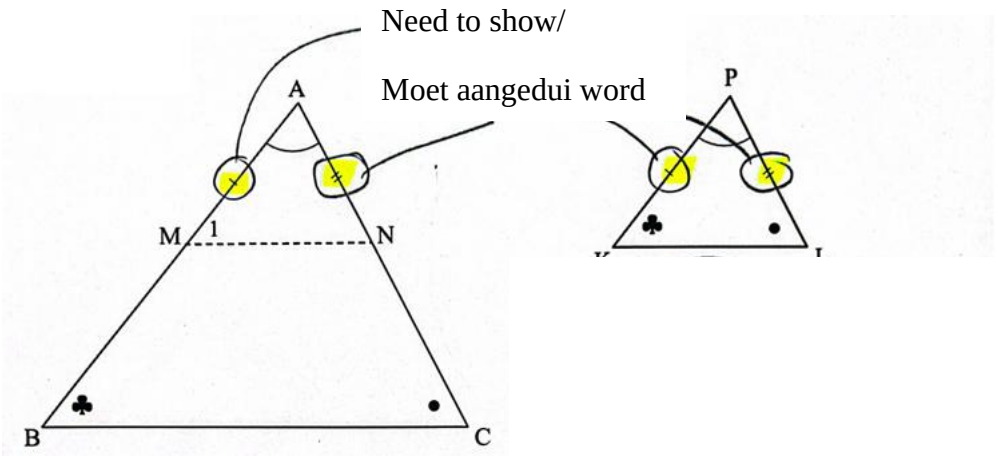
- B_2 Also have other reasons (= chords subtends = angles)
- Isosceles triangle is NOT a reason (angles opposite = sides)
- Labelling of angles must be specific



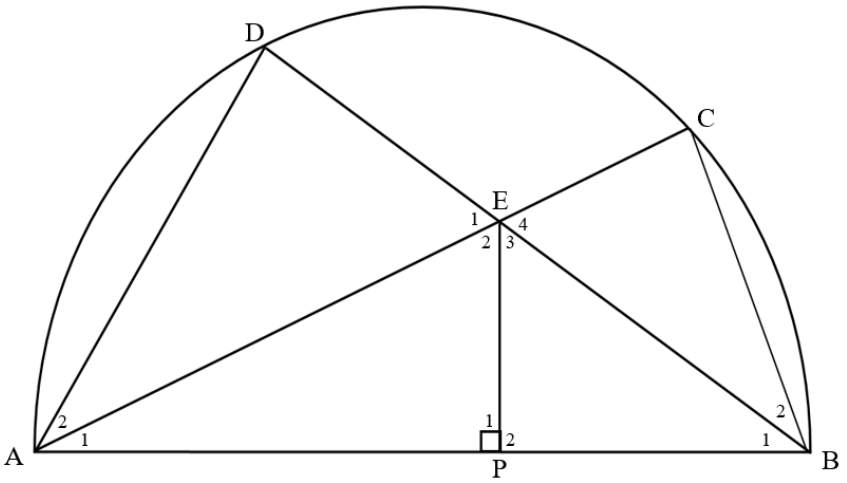
8.1	$\hat{A}_1 = x$ [tan chord / *rklyn koordstelling*]	✓ S ✓ R
	$\hat{C}_2 = x$ [∠s in the same segment/*∠e in dieselfde sirkel segment*]	✓ S ✓ R
	$\hat{A}_2 = x$ [∠s opp. = sides/*∠e teenoor = sye*]	✓ S ✓ R
	$\hat{B}_2 = x$ [∠s in the same segment/*∠e in dieselfde sirkel segment*]	✓ S ✓ R (8)
8.2.1	$\hat{C}_1 = 90° - x$ [$\angle^s$ on a straight line/$\angle^e$ *op 'n reguitlyn*]	✓ S
	$\hat{D}_2 = 90°$ [∠ in semi circle./*∠ in halfsirkel*]	✓ S ✓ R
	$\hat{D}_3 = 90°$ [$\angle^s$ on a straight line/$\angle^e$ *op 'n reguitlyn*]	✓ S/R
	$\hat{F}_1 = 90° - x$ [sum of Δ/*som* $\angle^e$ *v*Δ] *of* [*ext ∠ / buite ∠*]	✓ S/R (5)
	$\hat{C}_1 = \hat{F}_1$	
8.2.2	In ΔFDA and/*en* ΔADM is:	
	$\hat{D}_3 = \hat{D}_2 = 90°$ ..... proven / *bewys in* 8.2.1	✓ S both/beide ∠
	$\hat{A}_1 = \hat{A}_2 = x$ ..... proven / *bewys in* 8.1	✓ S
	AD = AD ..... common / *gemeenskaplik*	
	$\therefore \Delta FDA \equiv \Delta MDA$ ..... AAS	✓ S/R (3)
	$\therefore FD = DM$	

[16]

QUESTION/*VRAAG* 9



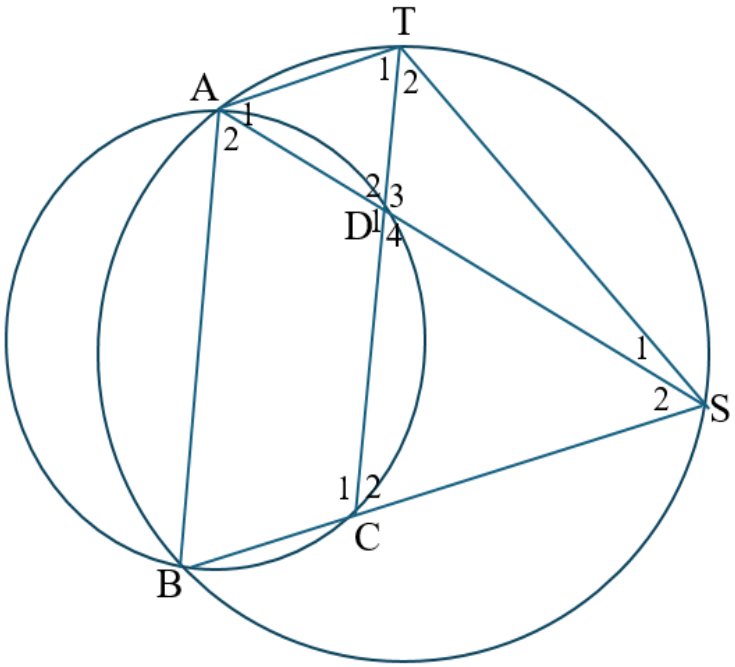
9.1	Konstuksie: Teken lyn MN, waar M en N punte op AB en AC onderskeidelik is. AM =PK and AN = PL Construction: Draw line MN, where M and N are points on AB and AC respectively. AM =PK and AN = PL In ΔAMN and/*en* ΔPKL is: $\hat{A} = \hat{P}$ [given / *gegee*] AM = PK [construction / *konstruksie*] AN = PL [construction / *konstruksie*] $\therefore \Delta AMN \equiv \Delta PKL$ [$S \angle S$] $\therefore \hat{M}_1 = \hat{K}$ *But* $\hat{B} = \hat{K}$ [given / *gegee*] $\therefore \hat{M}_1 = \hat{B}$ $\therefore MN \parallel BC$ [corr $\angle^s$ *are* = / *ooreenkomst* $\angle^e$ *is* =] $\frac{AB}{AM} = \frac{AC}{AN}$ [prop th / *ewered st*, line $\parallel$ one side of a Δ / *lyn* $\parallel$ *een sy v* Δ] or/*of* MN||BC But AM = PK and/en AN = PL $\therefore \frac{AB}{PK} = \frac{AC}{PL}$	✓ construction/*konstruksie* *Need to show or write/* moet wys of uitskryf BD if no construction ✓ S/R ✓ S ✓ R ✓ S ✓ R (6)



9.2.1	In Δ BPE and/en ΔBDA: $\hat{B}_1$ *is* common / *gemeenskaplik* $\hat{P}_2 = \hat{D} = 90°$ $\left[\text{given/}gegee \text{ and / } en \angle^s \text{ in a semi-circle / } \angle in \frac{1}{2}\odot\right]$ $B\hat{A}D = \hat{E}_3$ $\left[3^{rd} \angle \text{ or / } of \text{ } sum / \text{ } som \text{ } van \angle^s\right]$ $\Delta BPE \text{ ||| } \Delta BDA$ $[\angle\angle\angle]$ $\therefore \frac{BP}{BD} = \frac{PE}{AD} = \frac{BE}{AB}$ $[\Delta BPE \text{ ||| } \Delta BDA]$ $\therefore \frac{BP}{BD} = \frac{PE}{AD}$	✓ S ✓ S ✓ S/R ✓ S/R (4)
9.2.2	$\hat{C} = \hat{D} = 90°$ $\left[\angle^s \text{ in a semi-circle / } \angle in \frac{1}{2}\odot\right]$ $AB^2 = AC^2 + BC^2$ $[pyth]$ $AB^2 = AD^2 + BD^2$ $[pyth]$ $AC^2 + BC^2 = AD^2 + BD^2$	✓ S ✓ S ✓ S (3)

[13]

QUESTION/*VRAAG* 10



10.1	$\hat{B}+\hat{D}=180°$ $\left[\text{opp } \angle^s \text{ cyclic quad} / \textit{teenoorst } \angle^e \textit{ v kvh}\right]$	✓ S/R
	$\hat{D}_1=\hat{D}_3$ $\left[\text{vert opp} / \textit{regoorst } \angle^e\right]$	✓ S/R
	$\hat{B}+\hat{D}_3=180°$	✓ S
	$\hat{B}+\hat{T}_1+\hat{T}_2=180°$ $\left[\text{opp } \angle^s \text{ cyclic quad} / \textit{teenoorst } \angle^e \textit{ vkvh}\right]$	✓ S/R
	$\hat{D}_3=\hat{T}_1+\hat{T}_2$	
	Or/*of*	
	$\hat{D}_1=\hat{D}_3$ $\left[\textit{vert opp } \angle / \text{regoorst} \angle\right]$	✓ S/R
	$\hat{D}_1=180°-B$ $\left[\text{opp } \angle^s \text{ cyclic quad} / \textit{teenoorst } \angle^e \textit{ v kvh}\right]$	✓ S/R
	$\therefore \hat{D}_3=180°-B$	✓ S
	$180°-B=\hat{T}_1+\hat{T}_2$ $\left[\text{opp } \angle^s \text{ cyclic quad} / \textit{teenoorst } \angle^e \textit{ v kvh}\right]$	✓ S/R
	$\hat{D}_3=\hat{T}_1+\hat{T}_2$	(4)

10.2	In ΔSTD and/*en* ΔSAT is: $\hat{S}_1 = \hat{S}_1$ [common / *gemeensk*] $\hat{D}_3 = \hat{T}_1 + \hat{T}_2$ [proved / *bewys in* 10.1] $\hat{T}_2 = \hat{A}_1$ [$3^{rd}\ \angle$ or / *of sum/ som van* $\angle^s$] $\Delta STD \,|||\, \Delta SAT$ [$\angle\angle\angle$]	✓ S/R ✓ S ✓ S/R (3)
10.3	In ΔSDC and/*en* ΔSBA is: $\hat{S}_1 = \hat{S}_1$ [common / *gemeensk*] $\hat{D}_4 = \hat{B}$ [ext $\angle$ cq / *buite* $\angle$ *v kvh*] $\hat{C}_2 = \hat{A}_2$ ext $\angle$ cq / *buite* $\angle$ *v kvh*[ ] $\Delta SDC \,|||\, \Delta SBA$ [$\angle\angle\angle$] $\therefore \frac{SD}{SB} = \frac{SC}{SA}$ $\therefore SD.SA = SC.SB$ → (1) And $\frac{ST}{SA} = \frac{SD}{ST}$ *from* 10.2 $\therefore ST^2 = SD.SA$ → (2) $\therefore\therefore ST^2 = SB.SC$	✓ S all 2 must be correct ✓ S/R ✓ S ✓ S ✓ S (5)

[12]

TOTAL/TOTAAL: 150

MARKING GUIDELINES / *NASIENRIGLYNE*

EXAMINATION *EKSAMEN*	**NATIONAL SENIOR CERTIFICATE** *NASIONALE SENIOR SERTIFIKAAT*
GRADE / *GRAAD*	12
DATE / *DATUM*	SEPTEMBER 2026
SUBJECT / *VAK*	MATHEMATICS / *WISKUNDE*
PAPER / *VRAESTEL*	2
MARK TOTAL / *PUNTETOTAAL*	150
DURATION (HOURS) / *TYDSDUUR (UUR)*	3
NUMBER OF PAGES / *AANTAL BLADSYE*	20

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NOTE:

- If a candidate answered a question **TWICE**, only mark the first attempt.
- If a candidate cancelled the first attempt and did not answer the question again, mark the cancelled attempt.
- The principle of consistent accuracy **(CA)** will be applied throughout the memorandum.
- If a candidate has given the answer only, without showing any necessary working out, only **ONE** mark will be given.

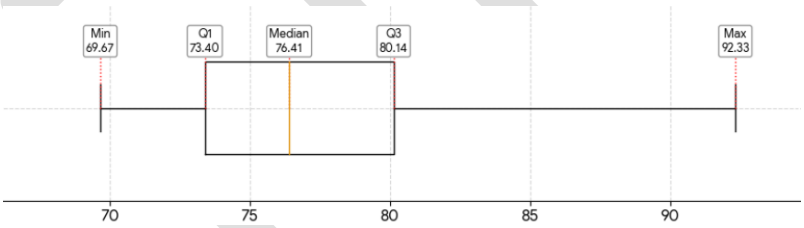
LET WEL:

- *As 'n kandidaat 'n vraag **TWEE KEER** beantwoord het, merk slegs die eerste poging.*
- *As 'n kandidaat die eerste poging gekanselleer het en nie die vraag weer beantwoord het nie, merk die gekanselleerde poging.*
- *Die beginsel van konsekwente akkuraatheid **(CA)** sal regdeur die memorandum toegepas word.*
- *Indien 'n kandidaat slegs die antwoord gegee het, sonder om die nodige bewerkings te toon, sal slegs **EEN** punt toegeken word.*

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QUESTION 1 / *VRAAG 1*			**[9 MARKS / *PUNTE*]**
1.1	$r = -0{,}79$ ✓✓ Do NOT penalise rounding / *Moet NIE afronding penaliseer nie*	✓✓ Answer/ *Antwoord*	(2)
1.2	Yes / Ja ✓ Relatively / Moderately strong negative correlation / *Relatiewe / matige sterk negatiewe korrelasie* ✓ **CA the answer from 1.1 / *CA antwoord vanaf 1.1***	✓ Yes/*Ja* ✓ Explanation/ *verduideliking*	(2)
1.3	✓ $y = 1{,}7390 - 0{,}0084x$ ✓ Penalise rounding / *Penaliseer afronding*	✓ $1{,}7390$ ✓ Equation/ *Vergelyking*	(2)
1.4	$y = 1{,}7390 - 0{,}0084(55)$ ✓ $= 1{,}28$ minutes ✓ Yes, interpolation ✓ (and the correlation is relatively strong). *Ja, intrapolasie (en relatiewe sterk korrelasie)*	✓ Sub/ *Vervang* ✓ Answer/ *Antwoord* ✓ Interpolation/ *Intrapolasie* (CA 1.3)	(3)
			[9]

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QUESTION / *VRAAG* 2			**[12 MARKS / *PUNTE*]**
2.1	Max: $89{,}18 - 64{,}31 = 24{,}87$ sec/*sek* ✓ Lando: $92{,}33 - 69{,}67 = 22{,}66$ sec/ *sek* ✓	✓ Answer/ *Antwoord* ✓ Answer/ *Antwoord*	(2)
2.2	Max: $80{,}40 - 75{,}38 = 5{,}02$ sec/ *sek* ✓ Lando: $80{,}14 - 73{,}40 = 6{,}74$ sec/ *sek* ✓	✓ Answer/ *Antwoord* ✓ Answer/ *Antwoord*	(2)
2.3	IQR, ✓ because it excludes extreme values which could be included in the range. ✓ *Interkwartielevariasiewydte, want dit sluit ekstreme waardes, wat by die variasiewydte bygevoeg word, uit*.	✓ IQR/ IKW ✓ Explanation/ *Verduideliking*	(2)
2.4	Max value/ *Maks waarde* – Q_2 = 92,33 – 76,41 = 15,92 Q_2 – min value/ *min waarde* = 76,41 – 69,67 = 6,74 ✓ ∴ Data is spread to the right ✓/ Positively skewed *Data versrei na regs / Positief skeef* ∴ $\bar{x} > 76$ ✓ OR / OF  ∴ Data is spread to the right/ *Data versprei na regs*. Skewed to the right / *skeef na regs*. ∴ $\bar{x} > 76$	✓ Calculating spread of data/ *Bereken verspreiding van data* (6,74 and 15,92) ✓ Spread to the right / *versprei na regs* ✓ Conclusion/ *Samevatting* *Or/of* ✓ diagram ✓ diagram on scale\ diagram op skaal ✓ Conclusion/ *Samevatting*	(3)
2.5	$\frac{85}{100} \times 240$ ✓ $= 204$ drivers/ *bestuurders* ✓ $85 \leq t < 90$ ✓ Answer only full marks/ *Slegs antw vol punte*	✓ $\frac{85}{100} \times 240$ ✓ 204 ✓ $85 \leq t < 90$	(3)
			[12]

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QUESTION / *VRAAG* 3			**[20 MARKS / *PUNTE*]**
3.1	G is midpt of/*van* AB. (Properties of a kite/ eienskappe van 'n vlieër) $x = \frac{-1+5}{2}$ ✓ $2 = \frac{0+y}{2}$ $x = 2$ ✓ $y = 4$ ✓	✓ Sub/ *Vervang* ✓ x ✓ y	(3)
3.2	$m_{CD} = \frac{-3}{2}$ ✓ $\therefore m_{EF} = \frac{-3}{2}$ ✓ (CD// EF)	✓ m_{CD} ✓ Answer/ *Antwoord*	(2)
3.3	$m_{EF} = \frac{-3}{2}$ $tan\,\theta = -\frac{3}{2}$ ✓ $\theta = 180° + (-56{,}31°) = 123{,}69°$	✓ $tan\,\theta = \frac{-3}{2}$	(1)
3.4	$m_{CA} = \frac{0-5}{-1-0}$ ✓ $= 5$ ✓	✓ Sub/ *Vervang* ✓ Answer/ *Antwoord*	(2)
3.5	$\tan C\hat{A}H = 5$ ✓ $C\hat{A}H = 78{,}69°$ ✓ $\alpha = \theta - C\hat{A}H$ $= 123{,}69° - 78{,}69°$ $= 45°$ ✓	✓ $\tan C\hat{A}H = 5$ ✓ $C\hat{A}H = 78{,}69°$ ✓ α	(3)

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3.6	$m_{tangent\ /\ raaklyn} = m_{EF} = \frac{-3}{2}$ ✓ (EF// CD and/ *en* CD//tangent / *raaklyn*) $y - 4 = \frac{-3}{2}(x - 5)$ ✓ $y = \frac{-3}{2}x + 11{,}5$ ✓	✓ $m_{tangent\ /\ raaklyn}$ ✓ Sub/ *Vervang* B$(5; 4)$ ✓ Equation/ *Vergelyking*	(3)
3.7	$m_{AC} = \frac{5-0}{0-(-1)} = 5$ ✓ $m_{BC} = \frac{5-4}{0-5} = \frac{-1}{5}$ ✓ $m_{AC} \times m_{BC} = 5 \times \frac{-1}{5} = -1$ $\therefore AC \perp BC$ or $\hat{C} = 90°$ ✓ ∴AB is the diameter of the circle (line subtends $90°\angle$) *AB is die middellyn van die sirkel(lyn onderspan $90°\angle$)* ∴ G is the midpoint of the circle/ ✓ *G is die middelpunt van die sirkel* $2 = \frac{0+x_k}{2}$ $2 = \frac{5+y_k}{2}$ $x_k = 4$ ✓ $y_k = -1$ ✓ $K(4; -1)$	✓ m_{AC} CA 3.4 ✓ m_{BC} ✓ Conclusion/ *Samevatting* $\hat{C} = 90°$ ✓ G midpt ✓ x-value/ *waarde* ✓ y-value/ *waarde*	(6)
			[20]

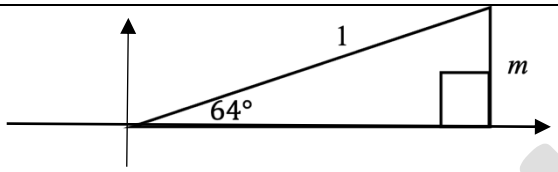
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QUESTION / *VRAAG* 4			**[18 MARKS / *PUNTE*]**
4.1	$x^2 + 6x + y^2 - 4y - 12 = 0$ $x^2 + 6x + 9 + y^2 - 4y + 4 = 12 + 9 + 4$ ✓ ✓ $(x+3)^2 + (y-2)^2 = 25$ $\text{A}(-3;2)$ ✓ $r = 5$ ✓	✓ completing the square/ *voltooi die vierkant* ✓ 25 ✓ $\text{A}(-3;2)$ ✓ r = 5	(4)
4.2	$(0+3)^2 + (y-2)^2 = 25$ ✓ $y^2 - 4y - 12 = 0$ ✓ $(y-6)(y+2) = 0$ ✓ $y = 6 \quad \text{or} \quad y = -2$ $\therefore \text{B}(0;6)$ ✓ $m_{AB} = \frac{2-6}{-3-0}$ $= \frac{4}{3}$ ✓	✓ $x = 0$ ✓ Std form/ *Std vorm* ✓ Factors/ *Faktore* ✓ Coordinates/ *koordiante* B ✓ Gradient/ *gradiënt AB*	(5)
4.3	$\therefore k = -3$ ✓✓	✓✓ Answer/ *Antwoord*	(2)
4.4	FE $= 15$ units/ *eenhede* ✓ BE $= 15$ units/ *eenhede* ✓ (Accept / *Aanvaar*: FE = BE = 15 units / *eenhede*) ✓✓ (tangents from the same point/ *raaklyne van dieselfde punt*) ✓	✓ Answer/ *Antwoord* ✓ Answer/ *Antwoord* ✓ Reason/ *Rede*	(3)

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4.5	$\text{EA} = \sqrt{(-3-12)^2 + \left(2-(-3)\right)^2}$ $EA = 5\sqrt{10}$ units/ *eenhede* ✓ $r = 5$ (original circle/ *oorspronklike sirkel*) Circles touch externally: $r + R = EA$ $\therefore 5 + R = 5\sqrt{10}$ ✓ $R = 10{,}81$ ✓ $\therefore (x-12)^2 + (y+3)^2 = 116{,}89$ ✓	✓ EA ✓ $5 + R = 5\sqrt{10}$ ✓ R value/ *waarde* ✓ Equation/ *Vergelyking*	(4)
			[18]

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QUESTION 5 / *VRAAG* 5			**[30 MARKS / *PUNTE*]**
5.1.1	$2\sin 32°.\cos 32°$ $= \sin 2(32°)$ ✓ $= \sin 64°$ $= \text{m}$ ✓	✓ double angle/ *dubbel hoek* ✓ Answer/ *Antwoord*	(2)
5.1.2	 $x = \sqrt{1-m^2}$ ✓ Pythagoras $\tan 116° = -\tan 64°$ ✓ $= -\frac{m}{\sqrt{1-m^2}}$ ✓	✓ x (on diagram or calculated / *op diagram of bereken*) ✓ Reduction/ *Herleiding* ✓ Answer/ *Antwoord*	(3)
5.1.3	$\cos 34° = \cos(64° - 30°)$ ✓ $= \cos 64° \cos 30° + \sin 64° \sin 30°$ ✓ $= \left(\sqrt{1-\text{m}^2}\right) \cdot \frac{\sqrt{3}}{2} + \text{m} \cdot \frac{1}{2}$ ✓ $= \frac{\sqrt{3}.\sqrt{1-m^2}}{2} + \frac{\text{m}}{2}$ $= \frac{\sqrt{3-3m^2}+m}{2}$ ✓	✓ Expansion/ *Uitbreiding* ✓ Compound angle/ *Saamgestelde hoek* ✓Sub/ *Vervang* ✓ Answer/ *Antwoord* One fraction/ *een breuk*	(4)

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5.2	$= \frac{\cos^2 15° - \frac{1}{2}(\sin^2 55° + \cos^2 55°)}{\sin 73° \cos 43° + \cos 73° (-\sin 43°)}$ ✓✓✓ $= \frac{\cos^2 15° - \frac{1}{2}(\sin^2 55° + \cos^2 55°)}{\sin 73° \cos 43° - \cos 73° \sin 43°}$ $= \frac{\cos^2 15° - \frac{1}{2}(1)}{\sin(73° - 43°)}$ ✓✓ $= \frac{\cos^2 15° - \frac{1}{2}}{\sin 30°}$ ✓ $= \frac{\cos^2 15° - \frac{1}{2}}{\frac{1}{2}}$ $= 2\cos^2 15° - 1$ ✓ $= \cos 30°$ $= \frac{\sqrt{3}}{2}$ ✓	✓ LCF/KGV $\frac{1}{2}$ ✓ $cos43°$ ✓ $-sin43°$ ✓ 1 ✓ $\sin(73° - 43°)$ ✓ $\sin 30°$ ✓ Cos double angle/*dubbel hoek* ✓ Answer/ *Antwoord*	(8)
5.3	$\frac{2\cos^3 x - 2\sin^3 x}{2 + \sin 2x} = \cos x - \sin x$ LHS: $= \frac{2(\cos^3 x - \sin^3 x)}{2 + 2\sin x \cos x}$ ✓✓ $= \frac{2(\cos x - \sin x)(\cos^2 x + \cos x \sin x + sin^2 x)}{2(1 + \sin x \cos x)}$ ✓✓ $= \frac{(\cos x - \sin x)(\cos^2 x + \sin^2 x + \cos x \sin x)}{1 + \sin x \cos x}$ $= \frac{(\cos x - \sin x)(1 + \cos x \sin x)}{1 + \sin x \cos x}$ ✓ $= \cos x - \sin x$ = RHS **OR / *OF***	✓ Sin double angle/ *dubbel hoek* ✓ common 2 num/ *gemeesk 2 in teller* ✓ common 2 denom/ *gemeesk 2 in noemer* ✓ Difference of cubes/ *verskil van 3de magte* ✓ $\cos^2 x + \sin^2 x = 1$ **OR / *OF***	(5)

FINAL

	LHS: $= \frac{2(\cos^3 x - \sin^3 x)}{2+\sin 2x}$ ✓ $= \frac{2[(\cos x - \sin x)(\cos^2 + \cos x \sin x + \sin^2 x)]}{2+\sin 2x}$ ✓ $= \frac{2[(\cos x - \sin x)(1+\cos x \sin x)]}{2+\sin 2x}$ ✓ $= \frac{(\cos x - \sin x)(2+2\cos x \sin x)}{2+\sin 2x}$ ✓ $= \frac{(\cos x - \sin x)(2+2\sin 2x)}{2+\sin 2x}$ ✓ $= \cos x - \sin x$ = RHS	✓ common 2 num/ *gemeesk 2 in teller* ✓ Difference of cubes/ *verskil van 3de magte* ✓ $\cos^2 x + \sin^2 x = 1$ ✓ x 2 ✓ Sin double angle/ *dubbel hoek*	

5.4.1	$\frac{5}{2}\cos x + \frac{5\sqrt{3}}{2}\sin x = -1$ $5\left(\frac{1}{2}\cos x + \frac{\sqrt{3}}{2}\sin x\right) = -1$ ✓ $\frac{1}{2}\cos x + \frac{\sqrt{3}}{2}\sin x = -\frac{1}{5}$ ✓ $\sin 30° \cdot \cos x$ ✓ $+ \cos 30° \cdot \sin x$ ✓ $= -\frac{1}{5}$ $\sin(x + 30°) = -\frac{1}{5}$	✓ HCF/ *GGV* 5 ✓ $-\frac{1}{5}$ ✓ $\sin 30° \cdot \cos x$ ✓ $+ \cos 30° \cdot \sin x$	(4)
5.4.2	$\sin(x + 30°) = -\frac{1}{5}$ Ref $\angle = 11{,}54°$ (11,53696) |||: $x + 30°$ ✓ $= 180° + 11{,}54° + k \cdot 360°$ $x = 161{,}54° + k \cdot 360°; k \in \mathrm{Z}$ ✓ IV: $x + 30° = 360° - 11{,}54° + k \cdot 360°$ $x = 318{,}46° + k \cdot 360°; k \in \mathrm{Z}$ ✓	✓ Method / *Metode* ✓ Using compound angle / Gebruik saamgestelde hoek ✓ $161{,}54°$ ✓ $318{,}46°$ $+k \cdot 360°; k \in \mathrm{Z}$	(4)
			[30]

FINAL

QUESTION / *VRAAG* 6			**[9 MARKS / *PUNTE*]**
6.1	$a = 2$ ✓ $p = 30°$ ✓ $b = -30°$ ✓	✓ a ✓ P ✓ b	(3)
6.2	$y\epsilon[-7; 5]$ ✓✓ **OR** $-7 \leq y \leq 5$	✓ Values/ *Waardes* ✓ Notation/ Notasie	(2)
6.3	$x\epsilon(-120°; -30°]$ ✓ $-120° < x \leq -30°$ **OR** $x\epsilon[30°; 60°)$ ✓ $30° \leq x < 60°$ **OR** $x\epsilon[150°; 210°]$ ✓ $150° \leq x \leq 210°$ All notation / *Alle notasie* ✓	✓ Values/ *Waardes* ✓ Values/ *Waardes* ✓ Values/ *Waardes* ✓ Notation/ *Notasie*	(4)
			[9]

FINAL

QUESTION / *VRAAG* 7			**[10 MARKS / *PUNTE*]**
7.1	$\cos\beta = \frac{CB}{x}$ ✓ $CB = x.\cos\beta$	✓ Sub/ *Vervang*	(1)
7.2	$\frac{FB}{\sin 2\beta} = \frac{2x}{\sin\beta}$ ✓ $\text{FB} = \frac{2x.\sin 2\beta}{\sin\beta}$ ✓ $\text{FB} = \frac{2x(2\sin\beta.\cos\beta)}{\sin\beta}$ ✓ $FB = 4x\cos\beta$ ✓ But $CD = FB - (FD + CB)$ and $CB = FD$ $CD = 4xcos\beta - 2(x.cos\beta)$ ✓ $\therefore CD = 2x\cos\beta$	✓ sin rule/ reël ✓ Simplify / *Vereenvoudig* ✓ sin double angle/ *dubbelhoek* ✓ FB ✓ Sub/ *vervang*	(5)
7.3	$AB = \sqrt{x^2 - x^2cos^2\beta}$ ✓ (Pythagoras) $h = \sqrt{x(1 - cos^2\beta)}$ $h = \sqrt{x(sin^2\beta)}$ $h = x.\sin\beta$ ✓ $Area\ EACD = \frac{1}{2}(2x.cos\beta + 4xcos\beta)(x.sin\beta)$ ✓ $= \frac{1}{2}(6x.cos\beta)(xsin\beta)$ $= 3x^2cos\beta.sin\beta$ $= \frac{3}{2}x^2(2sin\beta.cos\beta)$ ✓ $= \frac{3}{2}x^2sin2\beta$ ✓ **OR**	✓ Sub/ *vervang* ✓ *h* ✓ Sub/ *vervang* ✓ Simplify/ *vereenvoudig* ✓ Answer/ *Antwoord*	

FINAL

	$AB = \sqrt{x^2 - x^2cos^2\beta}$ ✓ (Pythagoras) $h = \sqrt{x(1 - cos^2\beta)}$ $h = \sqrt{x(sin^2\beta)}$ $h = x.sin\beta$ ✓ $Area\ EABF = 4xcos\beta \times x.sin\beta$ $= 4x^2sin\beta.cos\beta$ ✓ $Area\ \Delta ABC = \frac{1}{2} \times x.cos\beta \times x.sin\beta$ $= \frac{1}{2}x^2sin\beta.cos\beta$ ✓ $Area\ EACD = 4x^2sin\beta.cos\beta - 2(\frac{1}{2}x^2sin\beta.cos\beta)$ $= 4x^2sin\beta.cos\beta - x^2sin\beta.cos\beta$ $= 3x^2sin\beta.cos\beta$ $= \frac{3}{2}(2sin\beta.cos\beta)$ $= \frac{3}{2}x^2sin2\beta$ ✓	✓ Sub/ *vervang* ✓ *h* ✓ Area EABF ✓ Area ΔABC ✓ Answer/ *Antwoord*	(5)
			[11]

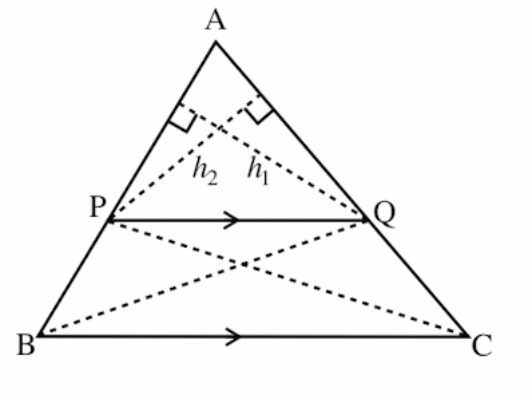
FINAL

QUESTION / *VRAAG* 8			**[11 MARKS / *PUNTE*]**
8.1	$\hat{D} = 90^\circ$ ✓ (∠ in semi-circle/ *∠ in 'n halwe sirkel*)	✓ S/R	(1)
8.2	$\hat{P}_1 = 90^\circ$✓ (midpt *O*; midpt chord/ *midpt O*; *midpt koord*) ✓ $\hat{A}_2 = 180^\circ - 90^\circ - 46^\circ$ (∠s of Δ/ ∠e van Δ) ✓ $\hat{A}_2 = 44^\circ$	✓ S ✓ R ✓ S&R	(3)
8.3	$\hat{A} = 90^\circ$ ✓ (∠ in semi-circle/ *∠ in 'n halwe sirkel*) $\hat{A}_1 = 46^\circ$ ✓ $\hat{E}_1 = 46^\circ$ ✓ (∠s opp = radii/ *∠e teenoor = radiusse*) **OR / *OF*** $\hat{B}_1 = 44^\circ$ ✓ (radii/ *radiusse*; ∠ opp=sides/ *∠ teenoor = sye*) $\hat{O}_2 = 88^\circ$ ✓ (∠ at centre = 2 × ∠ at circ/ middelp∠ = 2 × omtreks∠) $\hat{E}_1 = \frac{180^\circ - 88^\circ}{2}$ (radii; ∠s opp = sides; ∠e van Δ / radiusse; ∠e teenoor = sye; ∠e van Δ) $\hat{E}_1 = 46^\circ$	✓ S&R ✓ S ✓ S&R ✓ S&R ✓ S&R ✓ S&R	(3)
8.4	$\hat{B}_2 = 46^\circ$ ✓ (Alt ∠'s; AE || BD / *Verw ∠'s; AE || BD*) $E\hat{B}F = 90^\circ$ ✓ (radius ⊥ tangent / rdius ⊥ raaklyn) ✓ $\hat{B}_3 = 44^\circ$ ✓ **OR / *OF*** $\hat{D} = 90^\circ$ (∠ in semi-circle/ *∠ in 'n halwe sirkel*) ✓ $\hat{A} = 90^\circ$ (∠ in semi-circle/ *∠ in 'n halwe sirkel*) But, AEDB is a parralellogram/ *Maar AEBD is 'n parallelogram* ∴ AEDB is a rectangle (parm with 90°∠) / ✓ AEDB is 'n reghoek (parallelogram met 90°∠) ∴ $\hat{E}_2 = 90^\circ - 46^\circ = 44^\circ$ ✓ $\hat{B}_3 = 44^\circ$✓ (tan-chord/raaklyn koord stelling)	✓ S&R ✓ S ✓ R ✓ $\hat{B}_3 = 44^\circ$ ✓ S ✓ S&R ✓ $\hat{E}_2$ ✓ S&R	(4)
			[11]

FINAL

QUESTION / VRAAG 9 [16 MARKS / *PUNTE*]

9.1 **No construction no marks/ *Geen konstruksie geen punte*** ✓



Given/ *Gegee*: Δ ABC with $PQ \parallel BC$

To prove/ *Bewys dat*: $\frac{AP}{PB} = \frac{AQ}{QC}$

Construction/ *konstruksie*: In

ΔAPQ, draw height/ *teken hoogte*

h_1 with base/ *met basis* AP, and height / *en hoogte* h_2

with base/ *met basis* AQ. Draw/ *teken* BQ and/en CP.

$\frac{\text{Area } \triangle APQ}{\text{Area } \triangle BPQ} = \frac{\frac{1}{2}AP \cdot h_1}{\frac{1}{2}PB \cdot h_1} = \frac{AP}{PB}$ ✓

$\frac{\text{Area } \triangle APQ}{\text{Area } \triangle CQP} = \frac{\frac{1}{2}AQ \cdot h_2}{\frac{1}{2}QC \cdot h_2} = \frac{AQ}{QC}$ ✓

ΔBPQ and ΔCQP has the same base, PQ, and lies between the same parallel lines PQ and BC/ *het dieselfde basis, PQ, en le tussen dieselfde // lyne PQ en BC.*

∴ Area/*opperlvakte* ΔBPQ = Area/*opperlvakte* ΔCQP ✓

(same base; same height/ *selfde basis, selfde hoogte*) ✓

∴ $\frac{\text{Area } \triangle APQ}{\text{Area } \triangle BPQ} = \frac{\text{Area } \triangle APQ}{\text{Area } \triangle CQP}$ ✓

∴ $\frac{AP}{PB} = \frac{AQ}{QC}$

OR / OF

✓ Construction / *konstruksie*

✓ S

✓ S

✓ S

✓ R

✓ S

(6)

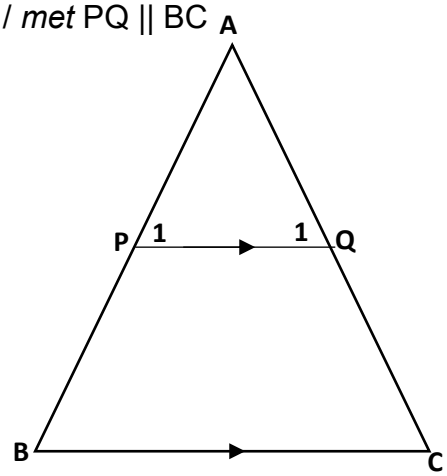
FINAL

Given / *Gegee*: ΔABC with / *met* PQ || BC

Prove / *Bewys*: $\frac{AP}{PB} = \frac{AQ}{QC}$

Let / *Stel* $A\hat{P}Q = \hat{P}_1$ and / *en*

$A\hat{Q}P = \hat{Q}_1$



In ΔAPQ and / *en* ΔABC:

$\hat{A}$ = $\hat{A}$ Common / *Gemeenskaplik*

$\hat{P}_1$ = $\hat{B}$ ✓ Corr ∠'s ; PQ || BC

Verw ∠'e: PQ || BC

$\hat{Q}_1$ = $\hat{C}$ ✓ Corr ∠'s ; PQ || BC

Verw ∠'e: PQ || BC

ΔAPQ ||| ΔABC ✓ A; A A / *H; H; H*

$\frac{AP}{AB} = \frac{AQ}{AC}$ ✓ Proportionality theorem; PQ || BC

OR Line || to side of Δ /

Eweredigheidst; PQ || BC OF Lyn || sy v Δ

But / *Maar:*

PB = AB – AP

And / *en* ✓

QC = AC - AQ

$\therefore \frac{AP}{AB - AP} = \frac{AQ}{QC - AQ}$ ✓

$\therefore \frac{AP}{PB} = \frac{AQ}{QC}$

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9.2.1	$\hat{A}_1 + \hat{A}_2 = \hat{B}_1 + \hat{B}_2$ ✓ (corresp / *ooreenkonstige* . ∠s, AC ∥ BD) $\hat{A}_1 = \hat{B}_1$ ✓ (= chords/*koorde* = ∠s) $\therefore \hat{A}_2 = \hat{B}_2$ $\therefore AD \,//\, BE$ (corresp*ooreenkonstige* ∠s =) ✓ **OR / *OF*** $\hat{A}_1 = \hat{B}_1$ ✓ (= chords/*koorde* = ∠s) $\hat{A}_1 = A\hat{D}B$ ✓ (Alt ∠s; CA ∥ DB ; Verw ∠e; CA ∥ DB) $\therefore \hat{B}_1 = A\hat{D}B$ $\therefore AD \parallel BE$ (Alt ∠s = ; Verw ∠e=) ✓	✓ S&R ✓ S&R ✓ R **OR / *OF*** ✓ S&R ✓ S&R ✓ R	(3)
9.2.2	$\frac{CD}{EG} = \frac{\sqrt{k}}{1}$ ✓ (given/ *gegee*) $But\ CD = DE$ $\therefore \frac{DE}{EG} = \frac{AB}{BG} = \frac{\sqrt{k}}{1}$ ✓ (prop theorem; AD ∥BE / ✓ *ewered.stelling ; AD ∥ BE*) OR/OF (line ∥ to side ΔAGD ; *lyn* ∥ *sy* Δ*AGD*) $\frac{\text{Area of }\Delta ABD}{\text{Area of }\Delta AGD} = \frac{\frac{1}{2}\times AB\times h}{\frac{1}{2}\times AG\times h}$ ✓ $\frac{\text{Area of }\Delta ABD}{\text{Area of }\Delta AGD} = \frac{\sqrt{k}}{\sqrt{k}+1}$ ✓ $\frac{\sqrt{k}}{\sqrt{k}+1} = \frac{3}{4}$ ✓ $4\sqrt{k} = 3\sqrt{k} + 3$ ✓ $\sqrt{k} = 3$ $\therefore k = 9$ ✓	✓ S&R ✓ S&R ✓ $\frac{\frac{1}{2}\times AB\times h}{\frac{1}{2}\times AG\times h}$ ✓ $\frac{\sqrt{k}}{\sqrt{k}+1}$ ✓ Equating/ = *aan* $\frac{3}{4}$ ✓ Simplification/ *Vereenvoudig* ✓ Answer/ *antwoord*	(7)
			[16]

FINAL

QUESTION / *VRAAG* 10		**[14 MARKS / *PUNTE*]**	
10.1	$\widehat{P_4} = 90°$ ✓ (midpt circle; midpt chord/*midpt sirkel*; *midpt koord*) $\hat{C} = 90°$ ✓ (Opp. ∠s of cyclic quad/ *teenoorst ∠ van koordevhoek*) $\widehat{P_1} = \hat{P}_4 = 90°$ ✓ (vert opp/ *regoorstaande*. ∠s) $\therefore D\hat{C}K = \hat{P}_1$ **OR / *OF*** $\widehat{P_1} = 90°$ ✓ (midpt circle; midpt chord/*midpt sirkel*; *midpt koord*) $\widehat{P_2} + \hat{P}_3 = 90°$ ✓ (∠s on str line / ∠e op reguitlyn) $\hat{C} = 90°$ ✓ (Opp. ∠s of cyclic quad/ *teenoorst ∠ van koordevhoek*) $\therefore D\hat{C}K = \hat{P}_1$	✓ S&R ✓ S&R ✓ S&R **OR / *OF*** ✓ S&R ✓ S&R ✓ S&R	(3)
10.2	In ΔKCD and/e*n* ΔEPF 1) $\widehat{K} = \hat{P}_3$ ✓ (∠s opposite/*teenoor* = sides/*sye*) $\hat{P}_3 = \hat{E}$ ✓ (corresp/ *ooreenkomst* ∠s, $KD \parallel EF$) $\therefore \widehat{K} = \hat{E}$ 2) $D\widehat{C}K = \hat{P}_1$ (already proven/ *reeds bewys*) 3) $\widehat{D} = \hat{F}$ ✓ (3^{rd} ∠s of Δ/ 3de∠ van Δ) $\therefore \Delta KCD \|\|\| \Delta EPF$ (∠∠∠) ✓	✓ S&R ✓ S&R ✓ S&R ✓ R	(4)
10.3	$\frac{KC}{EP} = \frac{CD}{PF} = \frac{KD}{EF}$ ✓ ($\|\|\| \triangle e$) ✓ $\therefore$ KC. EF = KD. EP	✓ S ✓ R	(2)

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10.4	$KD = \frac{KC.EF}{EP}$ ✓ (Proven in 10.2) $EP = KB$ ✓ $= \frac{(KB+BC)\checkmark .EF}{KB}$ $= \frac{KB.\text{EF} + BC.EF\ \checkmark}{KB}$ $= \frac{KB.EF}{KB} + \frac{BC.EF}{KB}$ ✓ $\therefore \text{KD} = \frac{\text{BC.EF}}{\text{KB}} + \text{EF}$	✓ S (KD =) ✓ Sub EP ✓ Sub $(KB + BC)$ ✓ Distribute ✓ Split fraction	(5)
			[14]
			GRAND TOTAL / *GROOTTOTAAL*: [150]

FINAL

Western Cape Government
Education
FOR YOU

EDUCATION DISTRICTS

MATHEMATICS PAPER 2

GRADE 12 MARKING GUIDELINE

TRIAL EXAMINATION

SEPTEMBER 2026

MARKS: 150

TIME: 3 hours

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 in order 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)
	'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 1

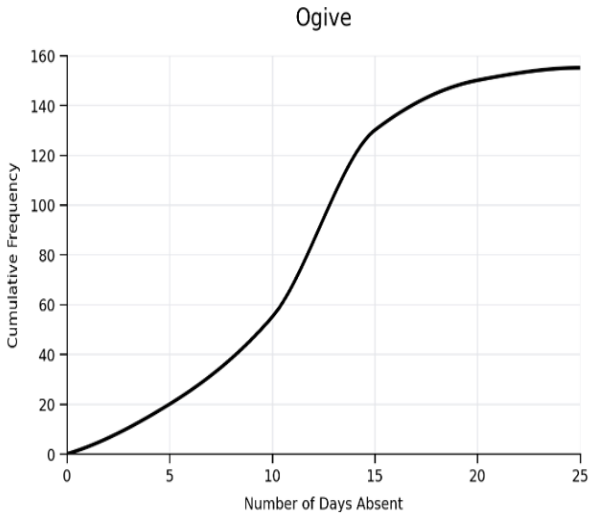
1.1

Cumulative Frequency
20
55
130
150
155

✓ first 3 values

✓ last 2 values (2)

1.2



✓ grounding
✓ correct plotting of points
✓ smooth curve (3)

1.3 Median $= 12$

✓ answer (1)

1.4 More than 15 days absent:

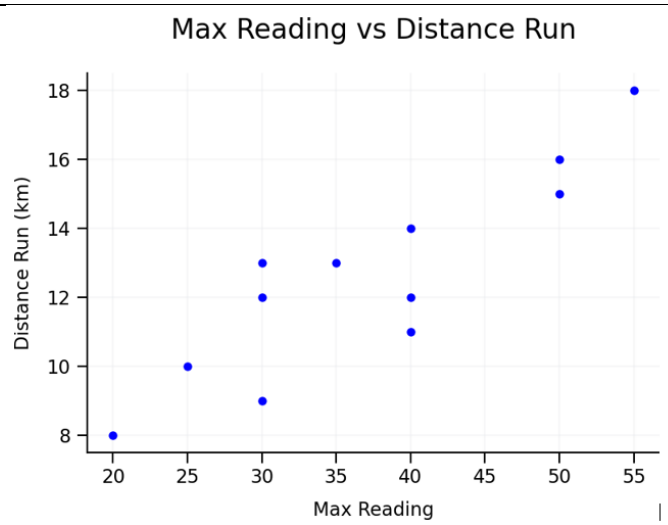
$= \frac{20 + 5}{155} \times 100$

$= 16{,}13\%$

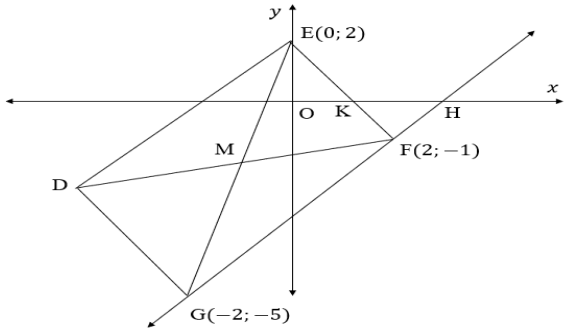
✓$20 + 5$

✓ answer (2)

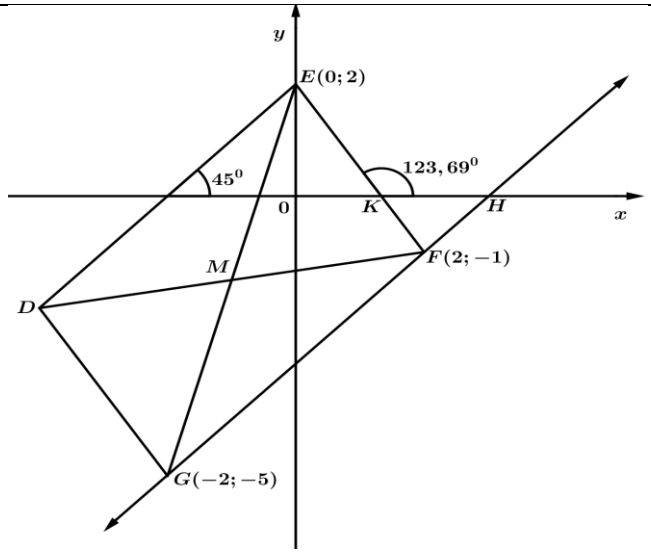
[8]

QUESTION 2		
2.1		✓ correct plotting of first 4 points ✓ correct plotting of second 4 points ✓ correct plotting of third 4 points (3)
2.2	$r = 0{,}89$ ∴ strong positive correlation	✓ $r = 0{,}89$ ✓ strong positive (2)
2.3	$A = 3{,}69$ $B = 0{,}24$ $y = 0{,}24x + 3{,}69$	✓ correct A value ✓ correct B value ✓ equation (3)
2.4.	$y = 0{,}24(26) + 3{,}69$ $y = 9{,}93$ km	✓ sub ✓ answer (2)
2.5	∴ Standard deviation remains the same/Unchanged	✓ Unchanged/Remain the same (1)
		[11]

QUESTION 3

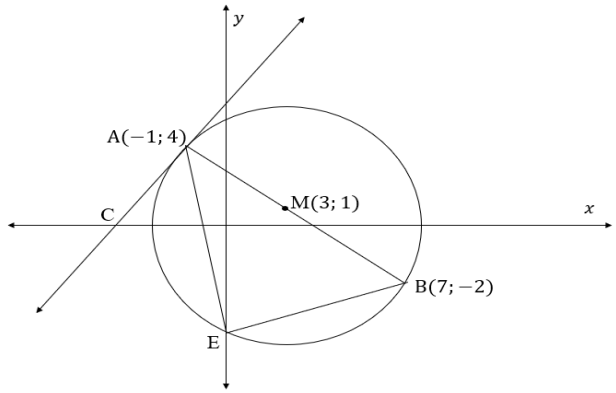


3.1	$M\left(\frac{-2+0}{2};\frac{-5+2}{2}\right)$ $M\left(-1;-\frac{3}{2}\right)$	✓ sub ✓ answer (2)
3.2	$GE=\sqrt{(-2-0)^2+(-5-2)^2}$ $GE=\sqrt{53}$	✓ sub ✓ answer (2)
3.3	$m_{GF}=\frac{-5+1}{-2-2}$ $=1$ $m_{DE}=m_{GF}=1$ OR $D(-4;-2)$ $m_{DE}=\frac{2-(-2)}{0-(-4)}$ $=1$	✓ sub ✓ gradient of GF ✓ gradient of DE (3) ✓ D ✓ substitution ✓ answer (3)
3.4	$m_{GH}=1$ $y=x+c$ $(-2;-5):\ -5=(-2)+c$ $c=-3$ $y=x-3$	✓ sub of coordinate ✓ answer (2)

3.5	$D(-4;-2)$	✓ x value and ✓ y value (2)
3.6	 $m_{EF} = \frac{-1-2}{2-0}$ or $m_{DG} = m_{EF}$ $= -\frac{3}{2}$ $\tan\theta = -\frac{3}{2}$ $\theta = 123{,}69°$ $m_{GF} = m_{DE} = 1$ $\tan\alpha = 1$ $\alpha = 45°$ $\hat{DEF} = 123{,}69° - 45°$ [ext ∠ of Δ] $= 78{,}69°$ $\therefore \hat{DGF} = 78{,}69°$ [opp ∠s of ∥ m] **OR** $DG = \sqrt{(-4+2)^2 + (-2+5)^2} = \sqrt{13}$ $GF = \sqrt{(-2-2)^2 + (-5+1)^2} = 4\sqrt{2}$ $DF = \sqrt{(-4-2)^2 + (-2+1)^2} = \sqrt{37}$ $DF^2 = GF^2 + DG^2 - 2GF.DG.\cos\hat{DGF}$	✓ sub into correct formula ✓ gradient of EF ✓ $\theta = 123{,}69°$ ✓ $\alpha = 45°$ ✓ $\hat{DGF} = 78{,}69°$ (5) ✓ DG ✓ GF ✓ DF

	$(\sqrt{37})^2 = (4\sqrt{2})^2 + (\sqrt{13})^2 - 2(\sqrt{13})(4\sqrt{2})\cos \hat{DGF}$ $\cos \hat{DGF} = \frac{(4\sqrt{2})^2 + (\sqrt{13})^2 - (\sqrt{37}}{2(\sqrt{13})(4\sqrt{2})}$ $\cos \hat{DGF} = 78{,}69°$	✓ sub into correct formula ✓ answers (5)
3.7	$GF = \sqrt{(-2-2)^2 + (-5+1)^2}$ $GF = 4\sqrt{2}$ $EF = \sqrt{(2-0)^2 + (-1-2)^2}$ $EF = \sqrt{13}$ $G\hat{F}E = 101{,}31°$ [co-interior ∠s, EF ∥ DG] Area $\Delta GEF = \frac{1}{2} \times 4\sqrt{2} \times \sqrt{13} \sin 101{,}31°$ $= 10{,}00 \text{ units}^2$ **OR** $m_{GE} = \frac{-5-2}{-2-0}$ $= \frac{7}{2}$ $\tan \alpha = \frac{7}{2}$ $\alpha = 74{,}05°$ $E\hat{G}F = 74{,}05° - 45°$ $= 29{,}05°$ $GF = \sqrt{(-2-2)^2 + (-5+1)^2}$ $GF = 4\sqrt{2}$ Area $\Delta GEF = \frac{1}{2} \times 4\sqrt{2} \times \sqrt{53} \sin 29{,}05°$ $= 10{,}00 \text{ units}^2$	✓ sub into formula ✓ $GF = 4\sqrt{2}$ ✓ S ✓ Sub into correct formula ✓ answer (5) ✓ sub into formula ✓ $\alpha = 74{,}05°$ ✓ $E\hat{G}F = 29{,}05°$ ✓ $GF = 4\sqrt{2}$ ✓ answer (5)
		[21]

QUESTION 4

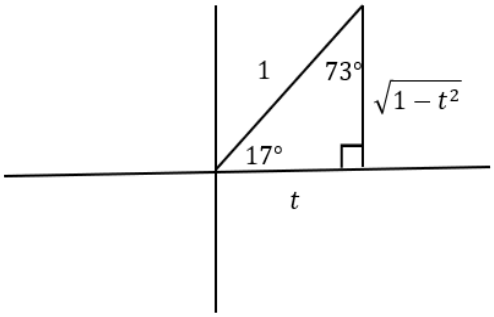


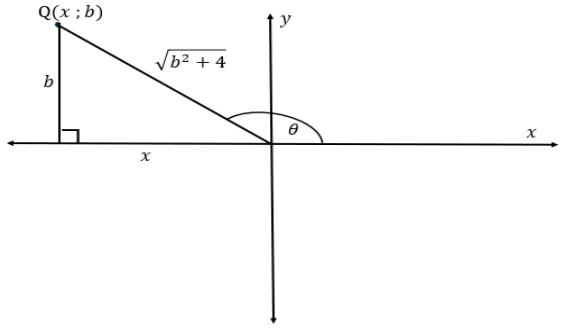
4.1	$(x-3)^2+(y-1)^2=r^2$ Sub: (-1;4) $(-1-3)^2+(4-1)^2=r^2$ $r^2=25$ $(x-3)^2+(y-1)^2=25$	✓ sub midpoint ✓ sub $(-1;4)$ ✓ answer (3)
4.2	$(0-3)^2+(y-1)^2=25$ $y^2-2y-15=0$ $(y-5)(y+3)=0$ $y\neq 5$ or $y=-3$	✓ sub $x=0$ ✓ std form ✓ answer with selection (3)
4.3	$m_{AM}=\frac{1-4}{3-(-1)}$ $=-\frac{3}{4}$ $m_{Tan}=\frac{4}{3}$ [radius⊥ tan] $y-4=\frac{4}{3}(x+1)$ $y=\frac{4}{3}x+\frac{16}{3}$ $\therefore 0=\frac{4}{3}x+\frac{16}{3}\therefore x=-4$ C$(-4;0)$	✓ gradient of radius ✓ gradient of tangent ✓ sub $(-1;4)$ ✓ equation ✓ coordinate of C

	$\text{AC} = \sqrt{(-4+1)^2 + (0-4)^2}$ $\text{AC} = 5$ units	✓ answer (6)

4.4	$k^2 + x^2 + y^2 - 35 = 2(xk + y)$ $k^2 + x^2 + y^2 - 35 = 2xk + 2y$ $x^2 - 2xk + k^2 + y^2 - 2y = 35$ $x^2 - 2xk + k^2 + y^2 - 2y + (-1)^2 = 35 + (-1)^2$ $(x-k)^2 + (y-1)^2 = 36$ Circle centre $(k\,;1)$ with $r = 6$ Externally: $\therefore k = 14$ or $k = -8$ Or Internally: $k = 4$ or $k = 2$	✓simplify ✓ completing square ✓ standard form ✓ ✓ centre and radius ✓ ✓ values for k (7)
		[19]

QUESTION 5

5.1.1	$\cos 163°$ $= -\cos 17°$ $= -t$	 ✓ $-\cos 17°$ ✓ answer (2)
5.1.2	 $\sin 13° = \sin(73° - 60°)$ $= \sin 73°.\cos 60° - \cos 73°.\sin 60°$ $= t.\frac{1}{2} - \sqrt{1-t^2}.\frac{\sqrt{3}}{2}$ $= \frac{t-\sqrt{3-3t^2}}{2}$ OR $\sin 13° = \sin(30° - 17°)$ $= \sin 3\,0°.\cos 1\,7° - \cos 3\,0°.\sin 1\,7°$ $= \frac{1}{2}t - \frac{\sqrt{3}}{2}\left(\sqrt{1-t^2}\right)$ $= \frac{t-\sqrt{3}\sqrt{1-t^2}}{2}$ $= \frac{t-\sqrt{3-3t^2}}{2}$	 ✓ compound angle ✓expansion ✓substitution (3) ✓ compound angle ✓expansion ✓substitution (3)

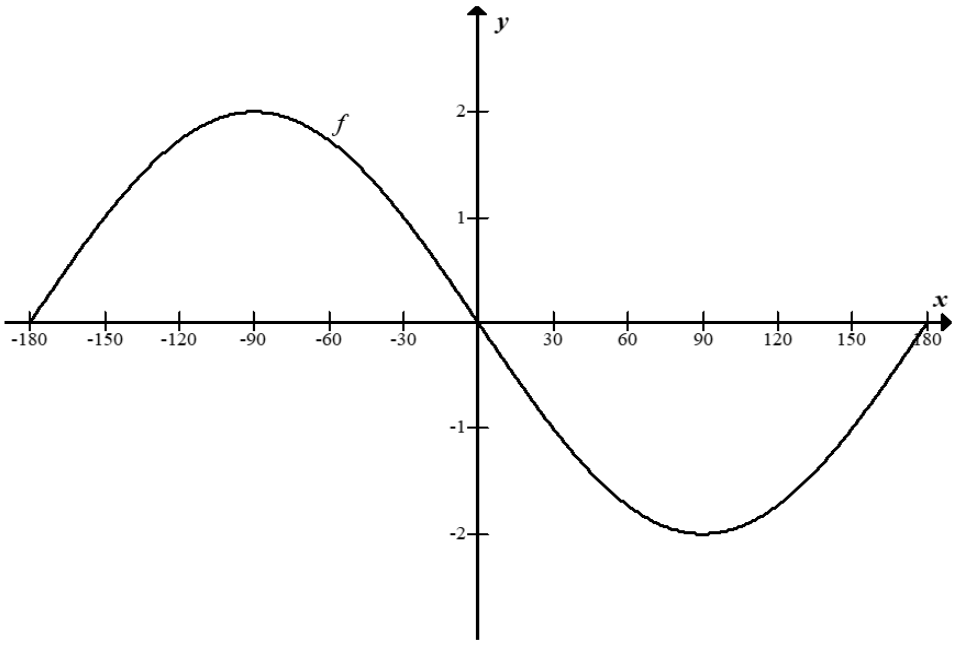
5.2	$= \frac{\sin x}{\cos x.\frac{\sin x}{\cos x}} + 2\sin x\,.(-\sin x)$ $= 1 - 2\sin^2 x$ $= \cos 2x$	✓ $\frac{\sin x}{\cos x}$ ✓ $\sin x$ ✓ $-\sin x$ ✓ simplify ✓ answer (5)
5.3.1	 $x^2 + b^2 = b^2 + 4$ Pythagoras Theorem $x^2 = 4$ $\therefore x = -2$	✓ pythagoras ✓ simplify ✓ selection (3)
5.3.2	$= -\tan\theta$ $= -\left(\frac{b}{-2}\right) = \frac{b}{2}$	✓$-\tan\theta$ ✓answer (2)
5.3.3	$\cos 2\theta = 1 - 2\sin^2\theta$ $= 1 - 2\left(\frac{b}{\sqrt{b^2+4}}\right)^2$ $= 1 - \frac{2b^2}{b^2+4}$ $= \frac{b^2+4-2b^2}{b^2+4}$ $= \frac{4-b^2}{b^2+4}$	✓ identity ✓squaring ✓ simplify single term (3)

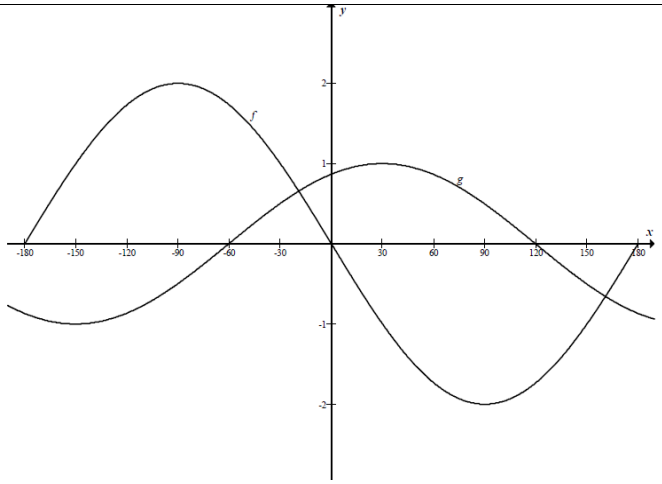
	OR $\cos 2\theta = \cos^2\theta - \sin^2\theta$ $= \left(\frac{-2}{\sqrt{b^2+4}}\right)^2 - \left(\frac{b}{\sqrt{b^2+4}}\right)^2$ $= \frac{4}{b^2+4} - \frac{b^2}{b^2+4}$ $= \frac{4-b^2}{b^2+4}$ **OR** $\cos 2\theta = 2\cos^2\theta - 1$ $= 2\left(\frac{-2}{\sqrt{b^2+4}}\right)^2 - 1$ $= \frac{8}{b^2+4} - \frac{b^2+4}{b^2+4}$ $= \frac{8-b^2-4}{b^2+4}$ $= \frac{4-b^2}{b^2+4}$	✓ identity ✓✓ squaring each term (3) ✓ identity ✓squaring ✓ simplify single term (3)

5.4	$3(1-2\sin^2 x) = 1 + 5\sin x$ $3 - 6\sin^2 x - 5\sin x - 1 = 0$ $-6\sin^2 x - 5\sin x + 2 = 0$ $6\sin^2 x + 5\sin x - 2 = 0$ $\sin x = 0{,}30$ or $\sin x \neq -1{,}13$ (N/A) $x = 17{,}46° + k.360$ Or $x = 162{,}54° + k.360; k\epsilon Z$	✓ $1 - 2\sin^2 x$ ✓ standard form ✓ factors ✓ $\sin x \neq -1{,}13$ ✓ $x = 17{,}46°$ ✓ $x = 162{,}54°$ ✓ $+k.360; k\epsilon Z$ (7)
5.5	$= -sin(\theta + 15°)\,cos(\theta + 75°) + cos(\theta + 15°)\,sin(\theta + 75°)$ $= sin(\theta + 75°)\,cos(\theta + 15°) - cos(\theta + 75°)\,sin(\theta + 15°)$ $= sin[(\theta + 75°) - (\theta + 15°)]$ $= sin\,60°$ $= \frac{\sqrt{3}}{2}$	✓$-\sin(\theta + 15°)$ ✓$\cos(\theta + 75°)$ ✓compound formula identity ✓ answer (4)
5.6	$(a+1)^2 = \left(\frac{3}{2}\cos\theta\right)^2$ $\boldsymbol{a^2 + 2a} + 1 = \frac{9}{4}\cos^2\theta$……..(1) $a^2 + 2a = 1$……(2) $\therefore 1 + 1 = \frac{9}{4}\cos^2\theta$ $\therefore \frac{8}{9} = \cos^2\theta$ $\cos 2\theta = 2\cos^2\theta - 1$ $= 2\left(\frac{8}{9}\right) - 1 = \frac{7}{9}$	✓squaring both sides ✓$a^2 + 2a + 1 = \frac{9}{4}\cos^2\theta$ ✓$a^2 + 2a = 1$ ✓$\cos^2\theta = \frac{8}{9}$ ✓ answer (5)

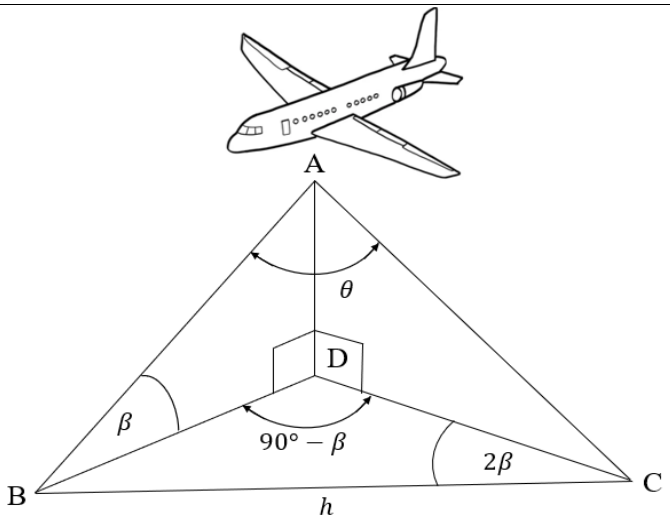
	OR $a+1=\frac{3}{2}\cos\theta$ $2a+2=3\cos\theta$ $\cos\theta=\frac{2a+2}{3}$ …….1 $a+2=\frac{1}{a}$ $a^2+2a=1$ $a^2=1-2a$ …….2 $\cos 2\theta=2\cos^2\theta-1$ $=2\left[\frac{2a+2}{3}\right]^2-1$ $=2\left[\frac{4a^2+8a+4}{9}\right]-1$ $=\frac{8a^2+16a+8}{9}-\frac{9}{9}$ $=\frac{8(1-2a)+16a-1}{9}$ $=\frac{8-16a+16a-1}{9}$ $=\frac{7}{9}$	✓$\cos\theta=\frac{2a+2}{3}$ ✓$a^2=1-2a$ ✓sub into identity ✓sub $1-2a$ ✓answer (5)
		[34]

QUESTION 6



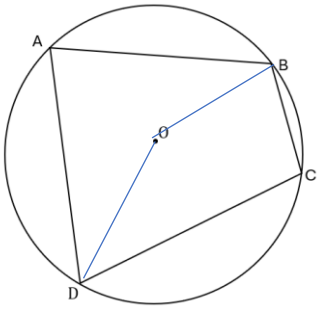
6.1	$720°$	✓✓answer (2)
6.2		✓ shape ✓ x −intercepts ✓amplitude (3)
6.3	$-90° < x < 30°$ or $x\epsilon(-90°; 30°)$	✓✓ $-90°, 30°$ ✓ notation (3)
		[8]

QUESTION 7

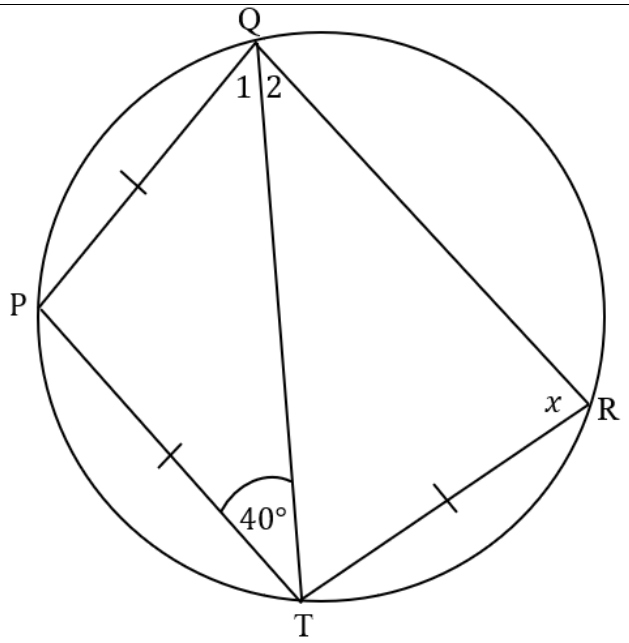


7.1	$\frac{\text{BD}}{\sin 2\beta} = \frac{h}{\sin(90°-\beta)}$ $\frac{\text{BD}}{2\sin\beta.\cos\beta} = \frac{h}{\cos\beta}$ $\text{BD} = 2h\sin\beta$	✓ sub into sine formula ✓ expansion ✓reduction (3)
7.2	$\cos\beta = \frac{\text{BD}}{\text{AB}}$ $\text{AB} = \frac{2h\sin\beta}{\cos\beta}$ $\text{AB} = 2h\tan\beta$	✓sub ✓ AB (2)
7.3	$\text{AB} = 2 \times 55 \times \tan 28°$ $= 58{,}49$ m $\text{BC}^2 = \text{AB}^2 + \text{AC}^2 - 2\text{AB}.\text{AC}.\cos\theta$ $\cos\theta = \frac{(58{,}49)^2+(28)^2-(55)^2}{2(58{,}49)(28)}$ $\cos\theta = 0{,}36\ldots$ $\theta = 68{,}88°$	✓AB = 58,49 m ✓ sub into correct formula ✓ simplify ✓answer (4)
		[9]

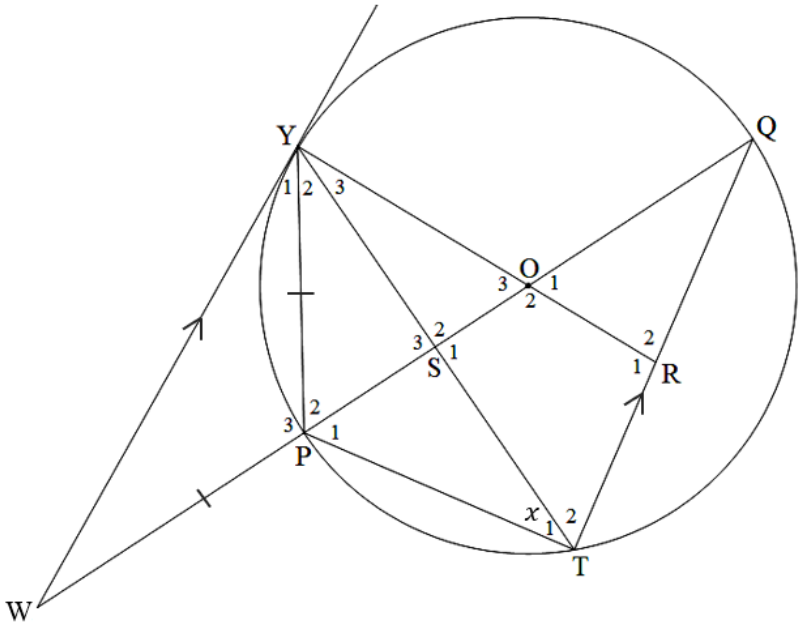
QUESTION 8



8.1	$Construct\ line\ DO\ and\ OB$ $Let\ D\hat{O}B = 2x$ $Reflex\ D\hat{O}B\ = 360° - 2x\ \ (\angle s\ around\ a\ point/\ \angle s\ in\ rev)$ $\hat{A} = x\ (\angle\ at\ centre = 2 \times \angle\ at\ circumference)$ $\hat{C} = 180° - x\ \ (\angle\ at\ centre = 2 \times \angle\ at\ circumference)$ $\hat{A} + \hat{C} = 180°$ (opp. ∠ of a cyclic quad.)	✓ Construction ✓ S ✓ S/R ✓ S (4)

		
8.2.1	$\widehat{Q}_1 = 40°$ (equal chords ;equal angles) $\widehat{P} = 100°$ (sum of $\angle s$ in Δ) or (int $\angle$s Δ) $x = 80°$ (opp. $\angle$ of a cyclic quad.)	✓ S ✓ S ✓ S/R (3)
8.2.2	$\widehat{Q}_2 = 40°$ (equal chord; equal angles)	✓ S ✓ R (2)
		[9]

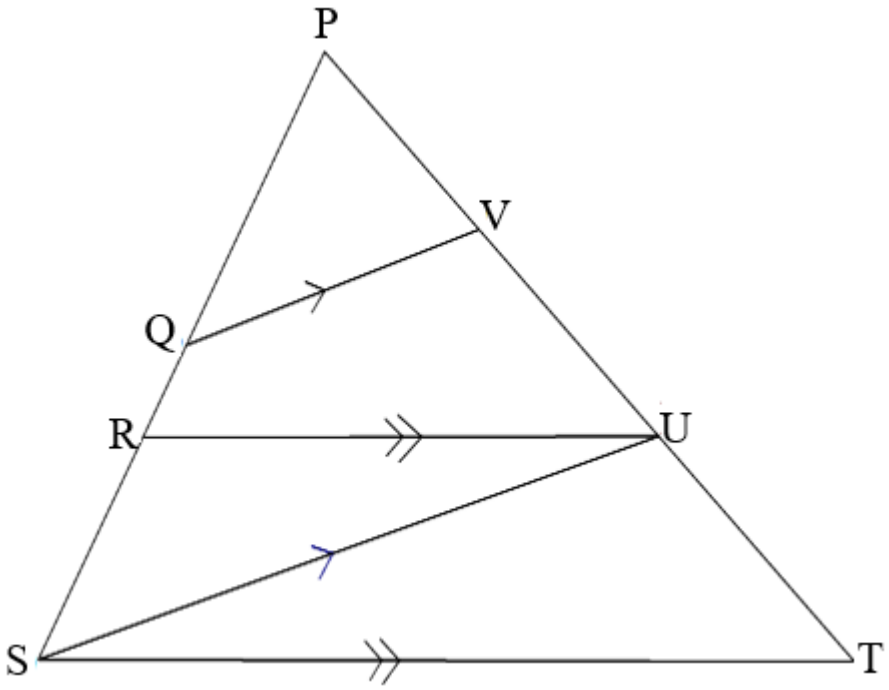
QUESTION 9



9.1.1	$\hat{Y}_1 = \hat{T}_1 = x$ (tan *chord theorem*)	✓ reason (1)
9.1.2	$\widehat{W} = \hat{Y}_1 = x$ $(equal \angle s\ opp = sides)$	✓ reason (1)
9.1.3	$\hat{Q} = \widehat{W} = x$ (alt. ∠ , WY $\|\|$ TQ)	✓ reason (1)
9.1.4	$\hat{Y}_2 = \hat{Q} = x$ $(angles\ in\ same\ segment)$	✓ reason (1)
9.2	$\hat{T}_2 = \hat{Y}_1 + \hat{Y}_2$ $\hat{T}_2 = 2x$ (alt. ∠ , WY $\|\|$ TQ) $\therefore \hat{T}_2 = 2\hat{T}_1$ **OR** $\hat{P}_2 = 2x$ $(ext \angle of\ \Delta)$ $\therefore \hat{T}_2 = 2x$ ($\angle s$ in samge segment)	✓ S ✓ R (2) ✓ S ✓ R (2)

9.3	$\hat{O}_3 = 2\hat{T}_1 = 2x$ ($\angle$ at centre $= 2 \times \angle$ at circumference) $T_2 = 2x$ (Proven) $\therefore SORT$ is a cyclic quad (converse ext $\angle$ of a cyclic quad)	✓ S/R ✓ R (2)
9.4	$\hat{T} = 90°$ ($\angle$ in semi $-$ circle) $\hat{T} = 3x$ $\therefore x = 30°$	✓ S/R ✓ value of x (2)
9.5	$O\hat{Y}W = 90°$ (rad $\perp$ tan) $\hat{R}_1 = 90°$ (co $-$ int $\angle s$, $WY \parallel TQ$) $\therefore TR = RQ$ (line from centre $\perp$ chord)	✓ S/R ✓ S ✓ R (3)
		[13]

QUESTION 10



10.1.1	$\frac{PU}{UT} = \frac{3a}{2a}$ (prop thm, RU || ST) $3a = 30\ cm$ $UT = 2a = 20\ cm$	✓ $3a = 30\ cm$ ✓ value of UT (2)

10.1.2	$\frac{PV}{VU}=\frac{PQ}{QS}=\frac{7b}{8b}$ prop thm; QV ||SU	✓S
	$\frac{PU}{UT}=\frac{PR}{RS}=\frac{3c}{2c}$ prop thm; RU || ST	✓S ✓R
	$5c = 15b$	
	$c = 3b$	
	$QR = 2b$	✓answer
	$\frac{QR}{RS}=\frac{2b}{6b}=\frac{1}{3}$	
	OR	
	$\frac{PV}{VU}=\frac{PQ}{QR}=\frac{7b}{8b}$ (*p*rop thm, QV || SU)	✓ S
	$\frac{PS}{PQ}=\frac{PU}{PV}=\frac{15c}{7c}$ (prop thm, QV || ST)	
	$\frac{PS}{PR}=\frac{PT}{PU}=\frac{5d}{3d}$ (prop theorem, RU || ST)	✓ S ✓ R
	$PS=\frac{15}{7}PQ \quad and\ PS=\frac{5}{3}PR$	
	$\frac{15}{7}PQ=\frac{5}{3}PR$	
	$\frac{PQ}{PR}=\frac{5}{3}\times\frac{7}{15}$	
	$\frac{PQ}{PR}=\frac{7p}{9p}$	
	$\therefore QR = 2p$ and $RS = 6p$	
	$\frac{QR}{RS}=\frac{1}{3}$	✓ answer
		(4)

10.2.1	$Let\ DG = x, then\ GC = x$ $DB = DG = x$ (DB = DG, radii) $\frac{AC}{FC} = \frac{BC}{CD} = \frac{3x}{2x}$ (prop thm , FD || AB) $\frac{AC}{FC} = \frac{3}{2}$	✓ R ✓ answer (2)
10.2.2	$E_1 = 90°$ (radius⊥ tangent) $\widehat{B} = 90°$ (radius⊥ tangent) *I*n ΔABC and ΔDEC 1. $C\ is\ common$ 2. $E_1 = B = 90°$ (proven) 3. $A = D_3$ (sum of inter∠*s* of Δ) ∴ ΔABC ||| ΔDEC A, A, A	✓ C common ✓ S ✓ R (3)
10.2.3	$\frac{AB}{DE} = \frac{BC}{EC}$ (proven, |||Δ) $AB = AE$ (tangents drawn to external points) $DE = DG = x$, radii $BC = 3x = 3DE$ $\therefore \frac{AE}{DE} = \frac{3DE}{EC}$ $DE^2 = \frac{AE\ .\ EC}{3}$	✓ S/R ✓ S ✓R ✓ BC = 3x = 3DE (4)
10.2.4	$\frac{AC}{FC} = \frac{3}{2}$ $(proven)$ $AC = 3k\ and\ FC = 2k$ $\frac{Area\ \Delta FDC}{Area\ \Delta ABC} = \frac{\frac{1}{2} \times FC \times CD \sin C}{\frac{1}{2} \times AC\ \times BC \sin C}$ $\frac{Area\ \Delta FDC}{Area\ \Delta ABC} = \frac{2k \times 2x}{3k \times 3x} = \frac{4}{9}$	✓ correct use of area rule ✓ subst ✓ answer (3)
		[18] **150**