



education

**MPUMALANGA PROVINCE
REPUBLIC OF SOUTH AFRICA**

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

MATHEMATICS PAPER 2

SEPTEMBER 2024

MARKING GUIDELINE / NASIENRIGLYNE

MARKS/PUNTE: 150

This marking guideline consist of 16 pages.

Hierdie nasienriglyne bestaan uit 16 bladsye.

NSC Marking Guideline

NOTE:

- If a candidate answered a question TWICE, mark only the FIRST attempt.
- If a candidate crossed out an answer and did not redo it, mark the crossed-out answer.
- Consistent accuracy applies to ALL aspects of the marking guidelines.
- Assuming values/answers in order to solve a problem is unacceptable.

LET WEL:

- As 'n kandidaat 'n vraag TWEE keer beantwoord het, sien slegs die EERSTE poging na.
- As 'n kandidaat 'n antwoord deurgehaal en nie oorgedoen het nie, sien die deurgehaalde antwoord na.
- Volgehoue akkuraatheid is op ALLE aspekte van die nasienriglyn van toepassing.
- Dit is onaanvaarbaar om waardes/antwoorde te veronderstel om 'n probleem op te los.

QUESTION 1/ VRAAG 1

Preparatory exam(x)	55	35	67	85	91	48	78	72	15	75	69	37
Final exam(y)	57	50	74	80	92	50	80	81	23	80	75	42

1.1	$a = 12,01$ $b = 0,88$ $y = 12,01 + 0,88x$	✓ value of a ✓ value of b ✓ Equation (3)
1.2	Prediction of Final Mark Preparatory Exam	✓ any correct two points ✓ straight line joining the points ✓ passing through $(\bar{x}; \bar{y})$ (3)
1.3	$y = 12,01 + 0,88(46)$ $y = 52\%$ OR calculator $y = 52,50\%$	✓ Substitution ✓ Answer (2)
1.4	$r = 0,98$	✓ Answer (1)

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1.5	There's a very strong positive correlation between preparatory marks and final marks. Daar is 'n baie sterk positiewe korrelasie tussen die rekordeksamen en die finale punte.	✓ Answer (1)
1.6	No, the preparatory exam mark is the independent variable. Hence we cannot determine the preparatory mark using the final mark. Nee, die rekordeksamen is die onafhanklike veranderlike. Die finale punt kan dus nie gebruik word om die rekordeksamenpunt te voorspel nie.	✓ Answer ✓ Reason (2)
		[12]

QUESTION 2 / VRAAG 2

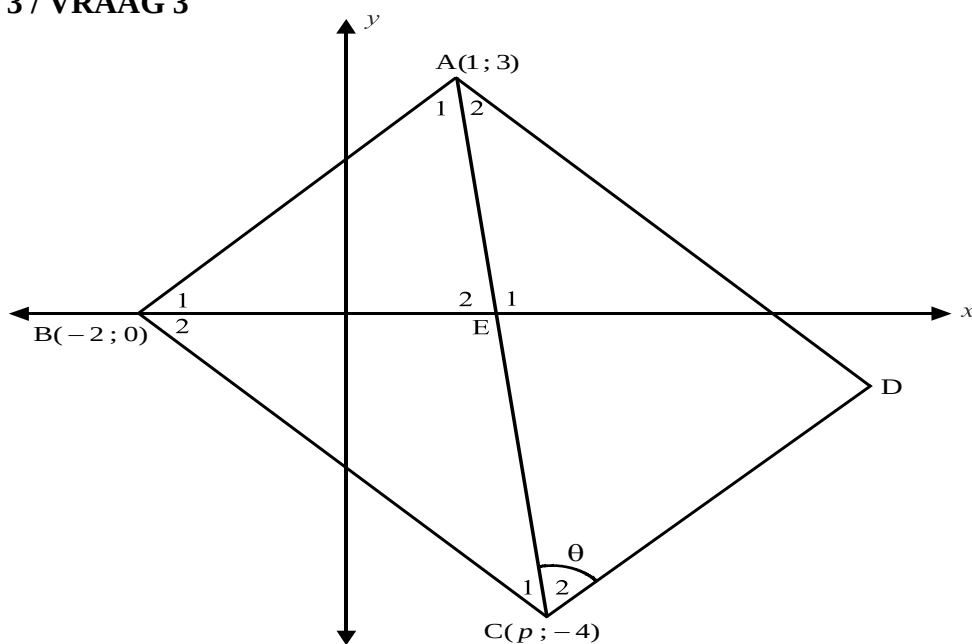
2.1	Expenditure(in rand) Uitgawes(in rand)	Frequency Frekwensie	Cumulative frequency Kumulatiewe frekwensie		
	$50 \leq x < 100$	24	24	✓ 76; 90	
	$100 \leq x < 150$	52	76		
	$150 \leq x < 200$	14	90	✓ 96; 100	
	$200 \leq x < 250$	6	96		
	$250 \leq x < 300$	4	100		(2)

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2.2	Cellphone expenditure for 100 learners.	✓ Correct points ✓ Grounding ✓ Shape (3)
2.3	$\bar{x} = \frac{(50 \times 24) + (125 \times 52) + (175 \times 14) + (225 \times 6) + (275 \times 4)}{100}$ $= \frac{12600}{100}$ $= 126$	✓ Method ✓ $\div 100$ ✓ Answer (3)
		[8]

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QUESTION 3 / VRAAG 3



3.1.1	$m_{AB} = \frac{3-0}{1-(-2)} = 1$	✓ substitution ✓ answer (2)
3.1.2	$AC^2 = (p-1)^2 + (-4-3)^2$ $\therefore (\sqrt{50})^2 = p^2 - 2p + 1 + 49$ $\therefore 50 = p^2 - 2p + 50$ $\therefore 0 = p^2 - 2p$ $\therefore 0 = p(p-2)$ $p = 0 \text{ or } p = 2$ $\therefore p = 2$	✓ dist formula used ✓ correct substitution ✓ standard form ✓ working to $p = 2$ (4)
3.1.3	Midpoint of AB / Middelpunt van AB: $M = \left(\frac{-2+1}{2}; \frac{0+3}{2} \right) = \left(-\frac{1}{2}; \frac{3}{2} \right)$ Gradient of $\perp$ line through M: $m = -1$ Equation of perp bisector / Vergelyking van middelloodlyn: $y - \frac{3}{2} = -1 \left(x + \frac{1}{2} \right)$ $\therefore y - \frac{3}{2} = -x - \frac{1}{2}$ $\therefore y = -x + 1$	✓ midpoint M ✓ grad of $\perp$ line ✓ sub into formula ✓ $y = -x + 1$ (4)

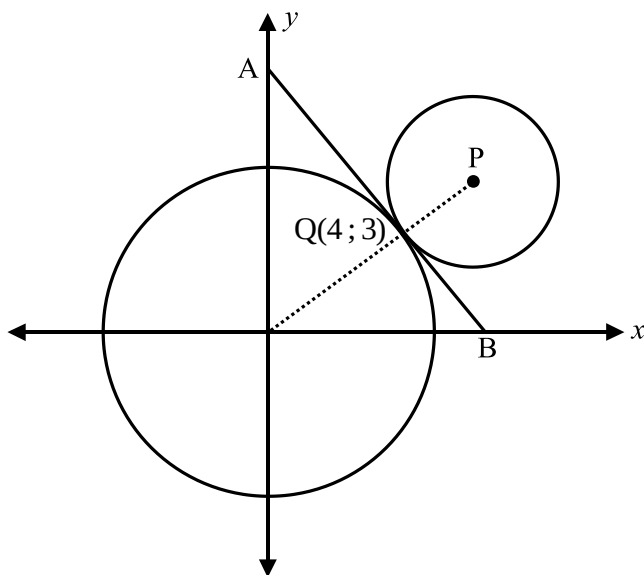
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3.1.4	D(5; -1)	✓ $x_D = 5$ ✓ $y_D = -1$ (2)
3.1.5	$\hat{B}_1 + \hat{B}_2 = 90^\circ$ ABCD is a rectangle / reghoek $\therefore$ AC is a diameter / middellyn Centre is the midpoint of AC/Middelpunt van sirkel is middelpunt van AC. $\left(\frac{1+2}{2}; \frac{-4+3}{2}\right) = \left(\frac{3}{2}; -\frac{1}{2}\right)$ Radius is half of the length of AC/Radius is helfte van AC: $r = \frac{\sqrt{50}}{2}$ Equation of circle / Vergelyking van sirkel: $\left(x - \frac{3}{2}\right)^2 + \left(y + \frac{1}{2}\right)^2 = \left(\frac{\sqrt{50}}{2}\right)^2$ $\therefore \left(x - \frac{3}{2}\right)^2 + \left(y + \frac{1}{2}\right)^2 = \frac{25}{2}$	✓ $\hat{B}_1 + \hat{B}_2 = 90^\circ$ ✓ $\left(\frac{3}{2}; -\frac{1}{2}\right)$ ✓ $r = \frac{\sqrt{50}}{2}$ ✓ equation of circle (4)
3.1.6	$\hat{A}_1 = \theta$ alt $\angle$ s = ; AB $\parallel$ CD $\tan \hat{B}_1 = m_{AB}$ $\therefore \tan \hat{B}_1 = 1$ $\therefore \hat{B}_1 = 45^\circ$ $\tan \hat{E}_1 = m_{AC} = \frac{-4-3}{2-1} = -7$ $\therefore \tan \hat{E}_1 = -7$ $\therefore \hat{E}_1 = 98,13010235^\circ$ $\theta = 98,13010235^\circ - 45^\circ$ $\therefore \theta = 53^\circ$	✓ $\hat{A}_1 = \theta$ ✓ $\hat{B}_1 = 45^\circ$ ✓ $m_{AC} = -7$ ✓ $\hat{E}_1 = 98,13010235^\circ$ ✓ $\theta = 53^\circ$ (5)

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3.2	$3x + by = -2$ $\therefore by = -3x - 2$ $\therefore y = -\frac{3}{b}x - \frac{2}{b}$ $-\frac{3}{b}x - \frac{2}{b} = -\frac{2}{3}x + 2$ $\therefore -9x - 6 = 2bx + 6b$ Substitute $x = -3$: $\therefore -9(-3) - 6 = -2b(-3) + 6b$ $\therefore 27 - 6 = 6b + 6b$ $\therefore 21 = 12b$ $\therefore b = \frac{21}{12} = \frac{7}{4}$	$\checkmark y = -\frac{3}{b}x - \frac{2}{b}$ $\checkmark$ equating equations Stel vergelykings gelyk $\checkmark$ substituting $x = -3$ $\checkmark b = \frac{7}{4}$ (4)
		[24]

QUESTION 4 / VRAAG 4

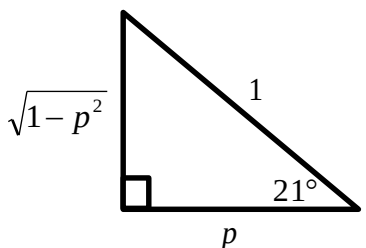


4.1	$x^2 - 12x + y^2 - 9y + 50 = 0$ $\therefore x^2 - 12x + 36 + y^2 - 9y + \frac{81}{4} = -50 + 36 + \frac{81}{4}$ $\therefore (x-6)^2 + \left(y - \frac{9}{2}\right)^2 = \frac{25}{4}$	$\checkmark (x-6)^2$ $\checkmark \left(y - \frac{9}{2}\right)^2$ $\checkmark \frac{25}{4}$ (3)
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4.2	$m_{OB} = \frac{3}{4}$ $\therefore m_{AB} = -\frac{4}{3}$ $y - 3 = -\frac{4}{3}(x - 4)$ $\therefore y - 3 = -\frac{4}{3}x + \frac{16}{3}$ $y = -\frac{4}{3}x + \frac{25}{3}$	$\checkmark m_{OB} = \frac{3}{4}$ $\checkmark m_{AB} = -\frac{4}{3}$ $\checkmark$ substitution of point $\checkmark$ equation (4)
4.3	Circumference of small = $2\pi\left(\frac{5}{2}\right) = 5\pi$ Circumference of large = $2\pi(5) = 10\pi$ Two revolutions / Twee omwentelings .	$\checkmark r = \frac{5}{2}$ $\checkmark r = 5$ $\checkmark 5\pi; 10\pi$ $\checkmark$ two revolutions (4)
4.4	$A\left(0; \frac{25}{3}\right) \quad B\left(\frac{25}{4}; 0\right)$ $\therefore OA = \frac{25}{3} \quad \text{and} \quad OB = \frac{25}{4}$ Area $\triangle AOB = \frac{1}{2} \times \frac{25}{4} \times \frac{25}{3} = \frac{625}{24} \text{ units}^2$	$\checkmark OA = \frac{25}{3}$ $\checkmark OB = \frac{25}{4}$ $\checkmark$ calculating area (3)
4.5	$Q(4; 3) \quad C(-4; 3)$ $\therefore CQ = 8 \text{ units}$	$\checkmark C(-4; 3)$ $\checkmark CQ = 8$ (2)
		[16]

QUESTION 5 / VRAAG 5

5.1.1	$p^2 + y^2 = 1^2$ $y = \sqrt{1 - p^2}$ $\tan 201^\circ = \tan(180^\circ + 21^\circ)$ $= \tan 21^\circ$ 	$\checkmark y = \sqrt{1 - p^2}$ $\checkmark \tan 21^\circ$ $\checkmark \frac{\sqrt{1 - p^2}}{p}$ (3)
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	$= \frac{\sqrt{1-p^2}}{p}$	
5.1.2	$\begin{aligned}\sin 42^\circ &= \sin 2(21^\circ) \\ &= 2 \sin 21^\circ \cos 21^\circ \\ &= 2 \left(\sqrt{1-p^2} \right) (p) \\ &= 2p\sqrt{1-p^2}\end{aligned}$	✓ $\sin 2(21^\circ)$ ✓ Identity ✓ Answer. (3)
5.1.3	$\begin{aligned}\cos(30^\circ + 21^\circ) &= \cos 30^\circ \cos 21^\circ - \sin 30^\circ \sin 21^\circ \\ &= \frac{\sqrt{3}}{2}(p) - \frac{1}{2}(\sqrt{1-p^2}) \\ &= \frac{p\sqrt{3} - \sqrt{1-p^2}}{2}\end{aligned}$	✓ $\cos(30^\circ + 21^\circ)$ ✓ Compound angle ✓ Substitution ✓ Answer (3)
5.2	$\begin{aligned}&\frac{\sin 210^\circ \cos 510^\circ}{\cos 315^\circ \sin(-135^\circ)} \\ &= \frac{(-\sin 30^\circ)(\cos 150^\circ)}{(\cos 45^\circ)(-\sin 135^\circ)} \\ &= \frac{(-\sin 30^\circ)(-\cos 30^\circ)}{(\cos 45^\circ)(-\sin 45^\circ)} \\ &= \frac{\left(-\frac{1}{2}\right) - \left(\frac{\sqrt{3}}{2}\right)}{\left(\frac{\sqrt{2}}{2}\right)\left(-\frac{\sqrt{2}}{2}\right)} \\ &= -\frac{\sqrt{3}}{2}\end{aligned}$	✓ $-\sin 30^\circ$ ✓ $-\cos 30^\circ$ ✓ $\cos 45^\circ$ ✓ $-\sin 45^\circ$ ✓ $-\frac{1}{2}$ ✓ $-\frac{\sqrt{2}}{2}$ ✓ $-\frac{\sqrt{3}}{2}$ (7)
5.3	$\begin{aligned}&\frac{\cos \theta - \cos 2\theta + 2}{3\sin \theta - \sin 2\theta} \\ &= \frac{\cos \theta - (2\cos^2 \theta - 1) + 2}{3\sin \theta - 2\sin \theta \cos \theta} \\ &= \frac{\cos \theta - 2\cos^2 \theta + 1 + 2}{\sin \theta(3 - 2\cos \theta)} \\ &= \frac{3 + \cos \theta - 2\cos^2 \theta}{\sin \theta(3 - 2\cos \theta)} \\ &= \frac{(3 - 2\cos \theta)(1 + \cos \theta)}{\sin \theta(3 - 2\cos \theta)} \\ &= \frac{1 + \cos \theta}{\sin \theta} \\ &= RHS\end{aligned}$	✓ $2\cos^2 \theta - 1$ ✓ $2\sin \theta \cos \theta$ ✓ $3 + \cos \theta - 2\cos^2 \theta$ ✓ $(3 - 2\cos \theta)(1 + \cos \theta)$ ✓ $\sin \theta(3 - 2\cos \theta)$ (5)

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5.4	$\sin \theta \sin \frac{3\theta}{2} + \cos \frac{3\theta}{2} \cos \theta = -\frac{\sqrt{3}}{2}$ $\cos \frac{3\theta}{2} \cos \theta + \sin \theta \sin \frac{3\theta}{2} = -\frac{\sqrt{3}}{2}$ $\cos \left(\frac{3\theta}{2} - \theta \right) = -\frac{\sqrt{3}}{2}$ $\cos \left(\frac{\theta}{2} \right) = -\frac{\sqrt{3}}{2}$ $\frac{\theta}{2} = 150^\circ + k \cdot 360^\circ \quad k \in \mathbb{Z} \quad \text{OR} \quad \frac{\theta}{2} = -150^\circ + k \cdot 360^\circ \quad k \in \mathbb{Z}$ $\theta = 300^\circ + k \cdot 720^\circ \quad k \in \mathbb{Z} \quad \theta = -300^\circ + k \cdot 720^\circ \quad k \in \mathbb{Z}$ OR $\text{ref } \angle = 30^\circ$ $\frac{\theta}{2} = 180^\circ - 30^\circ + k \cdot 360^\circ \quad \text{or} \quad \frac{\theta}{2} = 180^\circ + 30^\circ + k \cdot 360^\circ \quad k \in \mathbb{Z}$ $\theta = 300^\circ + k \cdot 720^\circ \quad k \in \mathbb{Z} \quad \text{or} \quad \theta = 420^\circ + k \cdot 720^\circ \quad k \in \mathbb{Z}$	$\checkmark \cos \left(\frac{3\theta}{2} - \theta \right)$ $\checkmark \frac{\theta}{2} = \pm 150^\circ + k \cdot 360^\circ$ $\checkmark \theta = 300^\circ + k \cdot 720^\circ$ $\checkmark -300^\circ + k \cdot 720^\circ \quad (4)$ OR $\checkmark \cos \left(\frac{3\theta}{2} - \theta \right)$ $\checkmark \frac{\theta}{2} = 180^\circ \pm k \cdot 360^\circ$ $\checkmark 300^\circ + k \cdot 720^\circ$ $\checkmark 420^\circ + k \cdot 720^\circ \quad (4)$
5.5.1	Maximum value is 1 and minimum value is -1	$\checkmark$ Answer (1)
5.5.2	Range of both graphs is/waardevers van beide grafieke: $-1 \leq y \leq 1$ $\sin \theta \cdot \cos \beta = -1$ $\sin \theta = 1$ and $\cos \beta = -1$ or $\sin \theta = -1$ and $\cos \beta = -1$ $\theta = 90^\circ$ and $\beta = -180^\circ$ or $\theta = 270^\circ$ and $\beta = 0^\circ$	$\checkmark \theta = 90^\circ$ $\checkmark \beta = -180^\circ$ $\checkmark \theta = 270^\circ$ $\checkmark \beta = 0^\circ \quad (4)$
		[30]

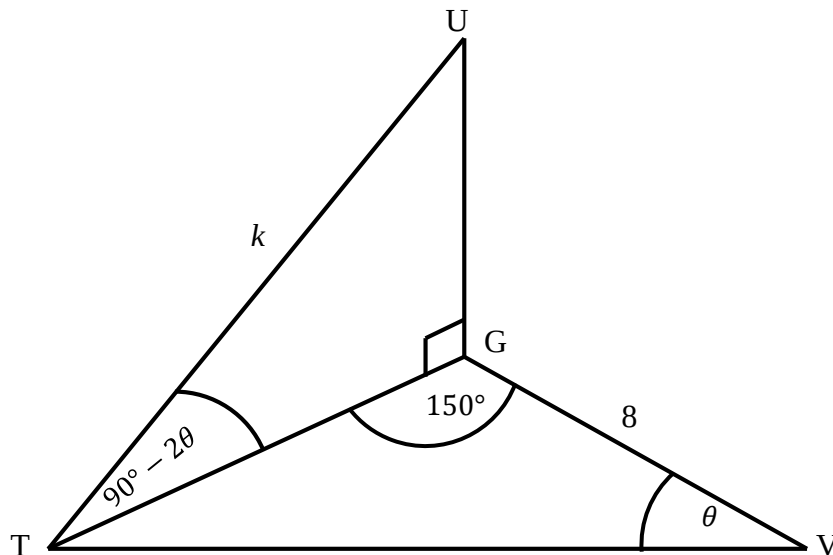
QUESTION 6 / VRAAG 6

6.1		$f(x)$ $\checkmark x - \text{intercepts}$ $\checkmark y - \text{intercept}$ $\checkmark$ Shape. $g(x)$ $\checkmark x - \text{intercepts}$ $\checkmark y - \text{intercept}$ $\checkmark$ Shape.
		(6)

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6.2.1	360°	✓ Answer (1)
6.2.2	0°	✓ Answer (1)
6.3.3	$90^\circ < x < 150^\circ$ OR $x \in (90^\circ; 150^\circ)$	✓ Notation ✓ Endpoints. (2)
		[10]

QUESTION 7 / VRAAG 7

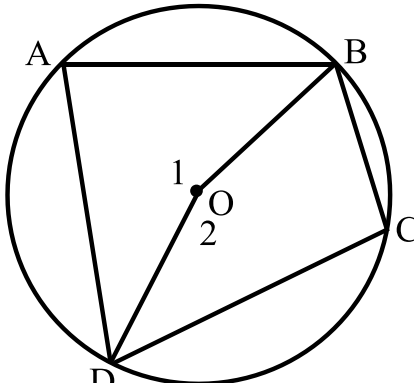


7.1	$\widehat{TUG} = 2\theta$	✓ Answer. (1)
7.2	$\frac{TG}{\sin 2\theta} = \frac{k}{\sin 90^\circ}$ OR $\cos(90^\circ - 2\theta) = \frac{TG}{k}$ $k \sin 2\theta = TG \times 1$ $\therefore TG = k \sin 2\theta$ $\sin 2\theta = \frac{TG}{k}$ $\therefore TG = k \sin 2\theta$	✓ Sine rule. ✓ $\sin 90^\circ = 1$ OR ✓ Trig ratio. ✓ $\sin 2\theta$ (2)

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7.3	$\frac{TV}{\sin 150^\circ} = \frac{TG}{\sin \theta}$ $\frac{TV}{\frac{1}{2}} = \frac{TG}{\sin \theta}$ $TV = \frac{\frac{1}{2}TG}{\sin \theta}$ $TV = \frac{\frac{1}{2}(k \sin 2\theta)}{\sin \theta}$ $TV = \frac{\frac{1}{2}(2k \sin \theta \cos \theta)}{\sin \theta}$ $\therefore TV = k \cos \theta$	$\checkmark \frac{TV}{\sin 150^\circ} = \frac{TG}{\sin \theta}$ $\checkmark \frac{1}{2}$ $\checkmark TV = \frac{\frac{1}{2}TG}{\sin \theta}$ $\checkmark 2 \sin \theta \cos \theta \quad (4)$
7.4	$\Delta TGV = \frac{1}{2} TG \cdot GV \sin 150^\circ$ $= \frac{1}{2} k \sin 2\theta \cdot 8 \cdot \frac{1}{2}$ $= 2k \sin 2\theta$ OR $\Delta TGV = \frac{1}{2} TV \cdot GV \cdot \sin \theta$ $= \frac{1}{2} k \cos \theta \cdot 8 \cdot \sin \theta$ $= 4 \cos \theta \cdot \sin \theta$ $= 2k(2 \cos \theta \sin \theta)$ $= 2k \sin 2\theta$	$\checkmark \text{Substitution.}$ $\checkmark \text{Method.} \quad (2)$ OR $\checkmark \text{Substitution.}$ $\checkmark \text{Method.} \quad (2)$
		[09]

QUESTION 8 / VRAAG 8

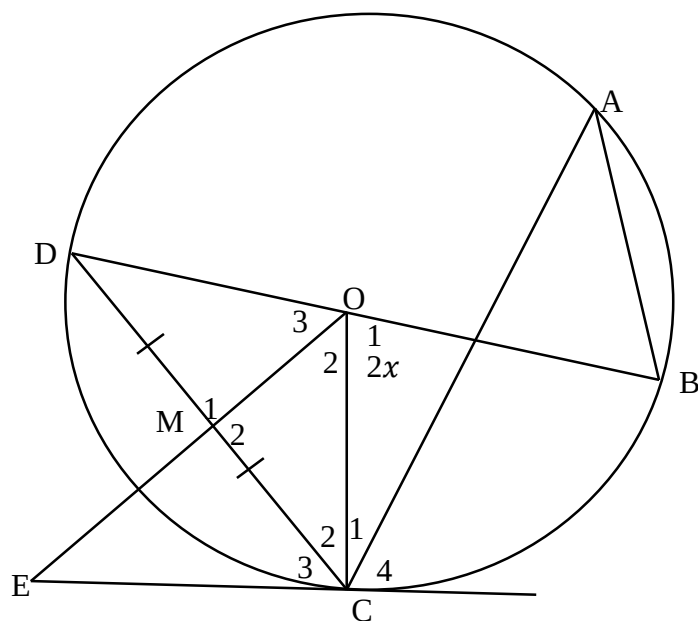
8.1	 $\hat{O}_1 = 2\hat{C}$ $\angle \text{ at centre} = 2 \times \angle \text{ at circ}$ $\hat{O}_2 = 2\hat{A}$ $\angle \text{ at centre} = 2 \times \angle \text{ at circ}$	$\checkmark \text{ construction}$ $\checkmark \hat{O}_1 = 2\hat{C}$ $\checkmark \hat{O}_2 = 2\hat{A}$
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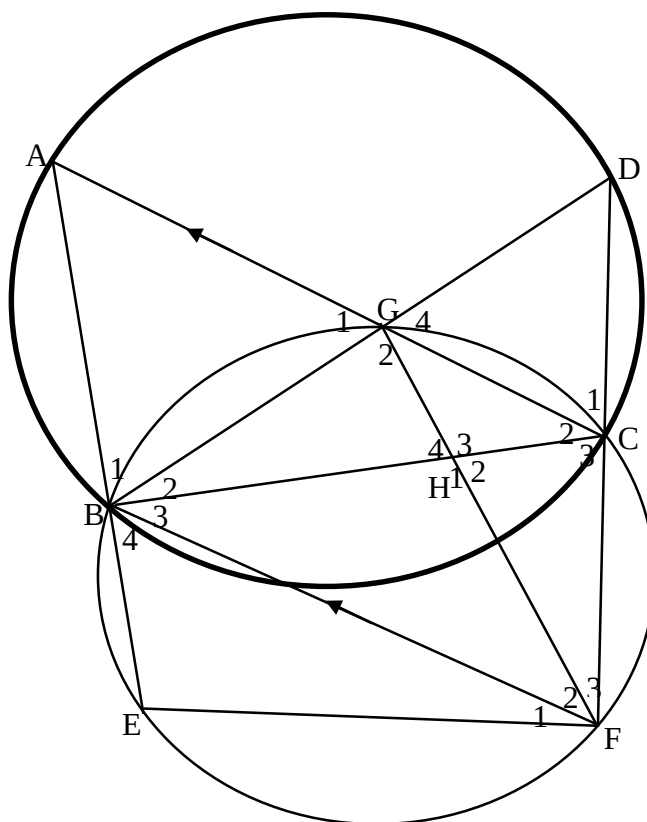
	$\hat{O}_1 + \hat{O}_2 = 2\hat{C} + 2\hat{A}$ $360^\circ = 2\hat{C} + 2\hat{A}$ $\angle$ s round a point $\therefore 180^\circ = \hat{C} + \hat{A}$ $\therefore \hat{A} + \hat{C} = 180^\circ$	✓ Writing the statement $360^\circ = 2\hat{C} + 2\hat{A}$ and hence $\hat{A} + \hat{C} = 180^\circ$ ✓ two correct reasons (5)
8.2		
8.2.1	$\hat{R}_1 = 65^\circ$ tan chord theorem	✓ S /R (1)
8.2.2	$\hat{R}_3 + \hat{R}_4 = 90^\circ$ tan $\perp$ radius $\therefore \hat{R}_4 = 55^\circ$	✓ S ✓ R (2)
8.2.3	$\hat{S}_1 + \hat{S}_2 = 90^\circ$ $\angle$ in semi-circle $\hat{T} = 35^\circ$ ext $\angle$ of Δ	✓ S ✓ R ✓ S (3)
		[11]

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QUESTION 9 / VRAAG 9



9.1	$\hat{O}_1 = \hat{A}$ [$\angle$ at the centre is $= 2x$ $\angle$ at the circumference] $2x = \hat{A}$ $\hat{A} = x$ But $\hat{A} = \hat{D} = x$ [$\angle$'s in the same segment] $\hat{D} = \hat{C}_2 = x$ [$\angle$'s opp = sides]	$\checkmark$ S $\checkmark$ R $\checkmark$ S $\checkmark$ R $\checkmark$ S $\checkmark$ R	(6)
9.2	$\hat{M}_2 = 90^\circ$ [$\angle$ from centre to midpoint of a chord] $\therefore \hat{O}_2 = 90^\circ - x$ [sum of $\angle$'s in a $\triangle$]	$\checkmark$ S $\checkmark$ R $\checkmark$ R	(3)
9.3	$\hat{O}_2 = 90^\circ - x$ [proved in 9.2] $\therefore \hat{C}_3 = 90^\circ - x$ [tan $\perp$ rad] $\therefore \hat{O}_2 = \hat{C}_3$ [both $= 90^\circ - x$] $\therefore$ EC is a tangent to circle passing through M, C & O. Converse tan-chord theorem.	$\checkmark$ S $\checkmark$ R $\checkmark$ S $\checkmark$ R	(4)
9.4	$\hat{C}_3 = 90^\circ - x$ [proven in 9.3] $\hat{O}_3 = 180^\circ - (90^\circ - x) - 2x$ [$\angle$'s on a straight line] $\therefore \hat{O}_3 = 90^\circ - x$ $\therefore \hat{O}_3 = \hat{C}_3$ [both $= 90^\circ - x$] $\therefore$ DOCE is a cyclic quadrilateral. Converse $\angle$'s in the same segment.	$\checkmark$ S $\checkmark$ R $\checkmark$ R	(3)
			[16]

QUESTION 10/ VRAAG10

10.1.1	Tan-chord theorem	✓ Answer (1)
10.1.2	Corresp. $\angle$ s ; $BF \parallel AC$	✓ Answer (1)
10.2.1	$\hat{C}_2 = \hat{B}_3$ [alt. $\angle$ s; $AC \parallel BF$] $\hat{B}_3 = \hat{G}_3$ [$\angle$ s in the same segment] $\hat{G}_3 = \hat{F}_2$ [Alt. $\angle$ s; $AC \parallel BF$] $\therefore \hat{B}_3 = \hat{F}_2$ [both = $\hat{G}_3$] $\therefore BH = FH$ [sides opp. = $\angle$ s]	✓ S/R ✓ S/R ✓ S ✓ R (4)
10.2.2	In $\triangle BEF$ and $\triangle DGF$ $\hat{E} = \hat{G}_4$ [ext. $\angle$ of cyclic quad.] $\hat{B}_4 = \hat{A}$ [alt. $\angle$ s; $AC \parallel BF$] $\hat{A} = \hat{D}$ [$\angle$ s in the same segment] $\therefore \hat{B}_4 = \hat{A}$ $\hat{F}_1 = \hat{F}_3$ [sum of $\angle$ s in a $\triangle$] $\triangle BEF \parallel \triangle DGF$ [$\angle \angle \angle$]	✓ S/R ✓ S/R ✓ R (3)

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10.2.3	$\hat{B}_2 = \hat{F}_3$	[$\angle$ s in the same segment]	✓ S/R
	$\hat{H}_2 = \hat{H}_4$	[vert. opp $\angle$ s]	✓ S/R
	$\therefore \hat{G}_2 = \hat{C}_3$	[sum of $\angle$ s in a Δ]	
	$\Delta BGH \parallel \Delta FCH$	[$\angle\angle\angle$]	✓ R
	$\frac{BG}{FC} = \frac{BH}{FH}$		✓ S
	$\therefore FH \cdot BG = BH \cdot FC$		(4)
			[13]

TOTAL/ TOTAAL:		150
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