



education

MPUMALANGA PROVINCE
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

MATHEMATICS P2

SEPTEMBER 2024

Stanmorephysics.com

MARKS: 150

TIME: 3 HOURS



**This question paper consists of 13 pages and 1 information sheet
and an answer book is provided.**

NSC

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. The question paper consists of 10 questions.
2. Answer ALL the questions in the SPECIAL ANSWER BOOK provided.
3. Clearly show ALL calculations, diagrams, graphs, etc. which you have used in determining the answers.
4. Answers only will NOT necessarily be awarded full marks.
5. You may use an approved scientific calculator (non-programmable and non-graphical) unless stated otherwise.
6. If necessary, round off answers to TWO decimal places, unless stated otherwise.
7. Diagrams are NOT necessarily drawn to scale.
8. Write neatly and legibly.



QUESTION 1

A Mathematics teacher wants to create a model by which she can predict a grade 12 learner's final marks. She decided to use her 2015 results to create the model.

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 Determine the equation of the least squares regression line in the form $y = a + bx$. (3)
- 1.2 Draw a scatter plot and show the regression line. (3)
- 1.3 Predict the final mark for a learner who attained 46% in the preparatory examination. (2)
- 1.4 Determine the correlation coefficient of the data. (1)
- 1.5 Describe the relationship between preparatory and final exam results. (1)
- 1.6 Could you use this equation to estimate the preparatory exam mark for a learner who attained 73% in the final exam? Give a reason for your answer. (2)

[12]

QUESTION 2

The table below shows the results from a survey of cell phone expenditure for 100 learners from a secondary school in Rustenburg.

Expenditure(in rand)	Frequency	Cumulative frequency
$50 \leq x < 100$	24	
$100 \leq x < 150$	52	
$150 \leq x < 200$	14	
$200 \leq x < 250$	6	
$250 \leq x < 300$	4	

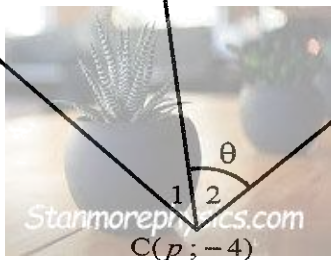
- 2.1 Complete the cumulative frequency table in the ANSWER BOOK. (2)
- 2.2 Draw an Ogive (cumulative frequency graph) for the data. (3)
- 2.3 Calculate the estimated mean of cell phone expenditure. (3)

[8]

3 triangle with
th of AC is $\sqrt{}$

3.1 ABC is a triangle with vertices A(1; 3), B(-2; 0) and C(p; -4) where $p > 0$.

The length of AC is $\sqrt{50}$ units.



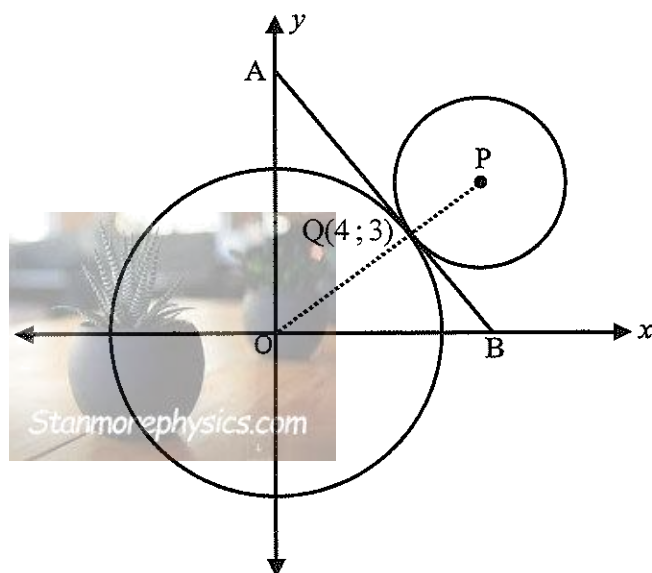
- tion of AB is

[25]

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QUESTION 4

Two circles in the diagram below represent two interlocking gears, which touch at the point $Q(4; 3)$. The circles have the following equations: $x^2 + y^2 = 25$ and $x^2 - 12x + y^2 - 9y + 50 = 0$



- 4.1 Show that the coordinates of P are $(6; 4\frac{1}{2})$. (3)
- 4.2 Determine the equation of the common tangent AB. (4)
- 4.3 If the larger gear makes one full revolution, how many times will the smaller gear turn completely? (4)
- 4.4 Find the area of $\triangle AOB$. (3)
- 4.5 Another tangent to the circle with centre O, drawn from A, touches the circle at C. And C is the reflection of Q by the y axis. Determine the length of CQ. (2)

[16]

QUESTION 5

5.1 If $\cos 21^\circ = p$ determine the following in terms of p .

5.1.1 $\tan 201^\circ$ (3)

5.1.2 $\sin 42^\circ$ (3)

5.1.3 $\cos 51^\circ$ (3)

5.2 Simplify : $\frac{\sin 210^\circ \cdot \cos 510^\circ}{\cos 315^\circ \cdot \sin(-135^\circ)}$ (7)

5.3 Prove the identity:

$$\frac{\cos \theta - \cos 2\theta + 2}{3 \sin \theta - \sin 2\theta} = \frac{1 + \cos \theta}{\sin \theta} \quad (5)$$

5.4 Determine the general solution of $\sin \theta \sin \frac{3\theta}{2} + \cos \frac{3\theta}{2} \cos \theta = -\frac{\sqrt{3}}{2}$. (4)

5.5 Given: $\sin \theta \cdot \cos \beta = -1$

5.5.1 Write down the maximum and minimum value of $\cos \beta$ (1)

5.5.2 Solve for $\theta \in [0^\circ; 270^\circ]$ and $\beta \in [-180^\circ; 90^\circ]$. (4)

[30]

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QUESTION 6

Given that $y = f(x) = 2\cos x$ and $y = g(x) = \sin(x + 30^\circ)$:

6.1 Sketch the graphs of f and g on the ANSWER BOOK on the same set of axes for $x \in [-180^\circ; 180^\circ]$. (6)

6.2 Read the following answers from your graphs:

6.2.1 Write down the period of f . (1)

6.2.2 Determine one value of x for which $f(x) - g(x) = 1,5$. (1)

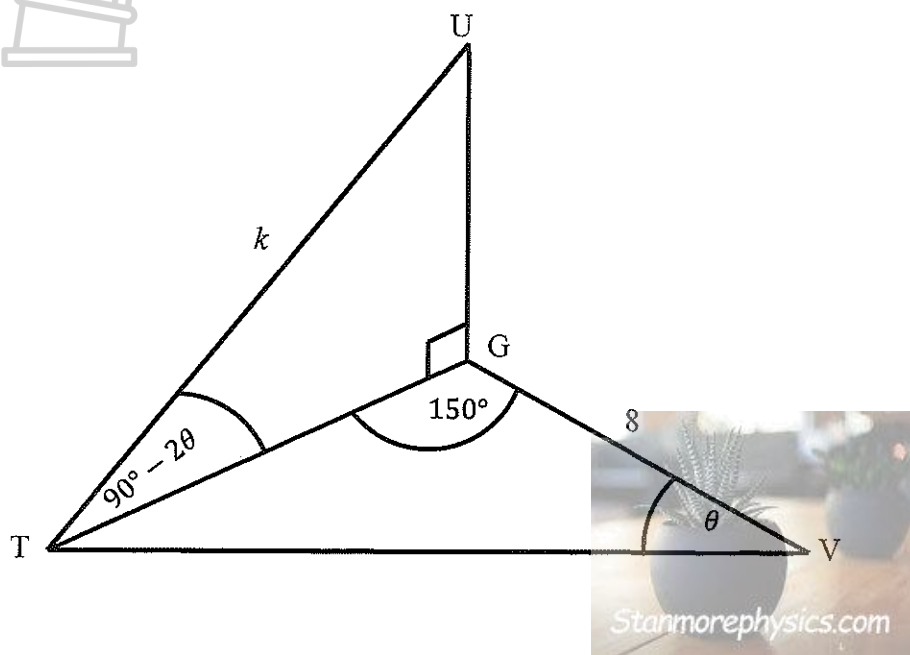
6.2.3 Determine the positive values of x for which $2\sin(x + 30^\circ) \cdot \cos x < 0$ (2)

[10]



QUESTION 7

A mouse on the ground at point T is looking up to an owl in a tree at point U and a cat to his right on the ground at point V. The angle of elevation from the mouse to the owl is $(90^\circ - 2\theta)$. $TU = k$ units, $GV = 8$ units, $\widehat{TGV} = 150^\circ$ and $\widehat{TVG} = \theta$.



- 7.1 Write down the size of $\widehat{TUG}$ in terms of θ (1)
- 7.2 Show that $TG = k \sin 2\theta$. (2)
- 7.3 Show that $TV = k \cos \theta$ (4)
- 7.4 Show that the area of $\triangle TGV = 2k \sin 2\theta$. (2)
- [9]

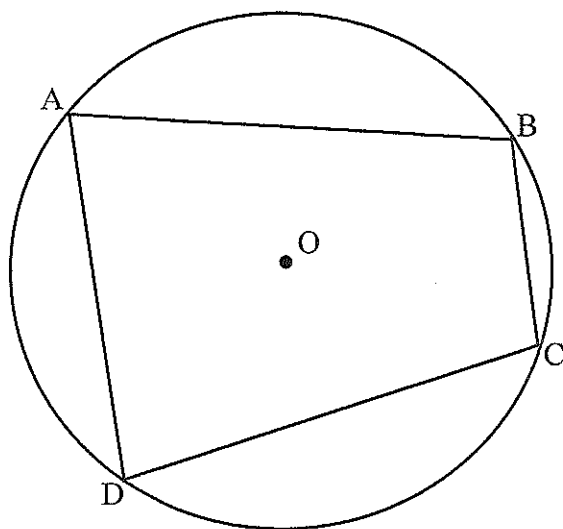
Give reasons for your statements and calculations in QUESTIONS 8, 9 and 10.

QUESTION 8

8.1 A, B, C and D are points on the circumference of the circle with centre O.

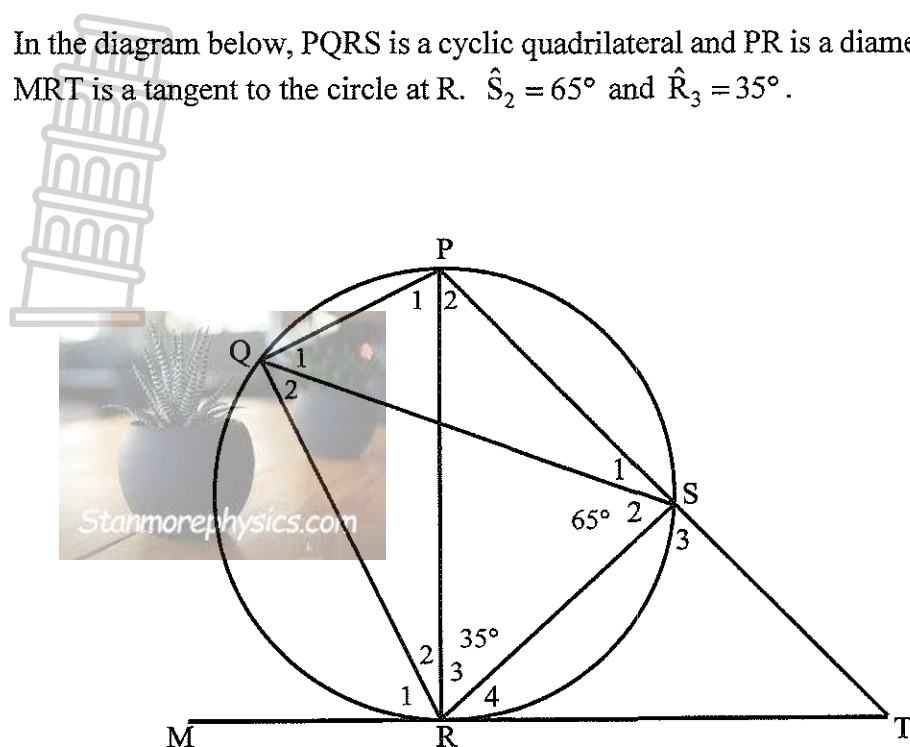
Prove the theorem which states that $\hat{A} + \hat{C} = 180^\circ$.

(5)



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- 8.2 In the diagram below, PQRS is a cyclic quadrilateral and PR is a diameter of the circle. The line MRT is a tangent to the circle at R. $\hat{S}_2 = 65^\circ$ and $\hat{R}_3 = 35^\circ$.



Determine the sizes of each of the following angles, with reasons:

8.2.1 $\hat{R}_1$ (1)

8.2.2 $\hat{R}_4$ (2)

8.2.3 $\hat{T}$ (3)

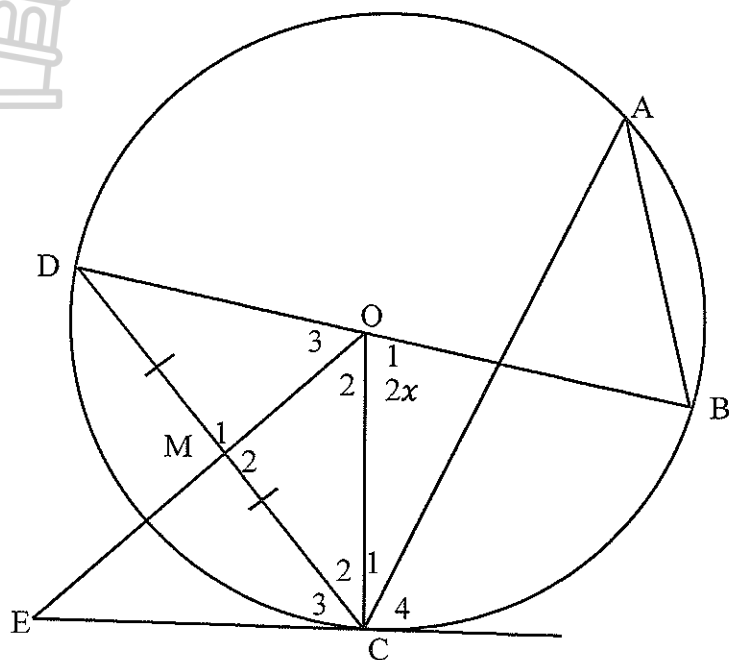
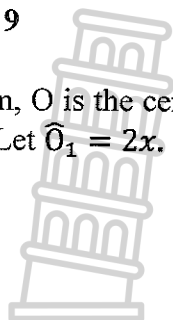
[11]



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QUESTION 9

In the diagram, O is the centre of the circle and EC is a tangent to the circle at C. $DM = MC$ and OME is a straight line. Let $\hat{O}_1 = 2x$.

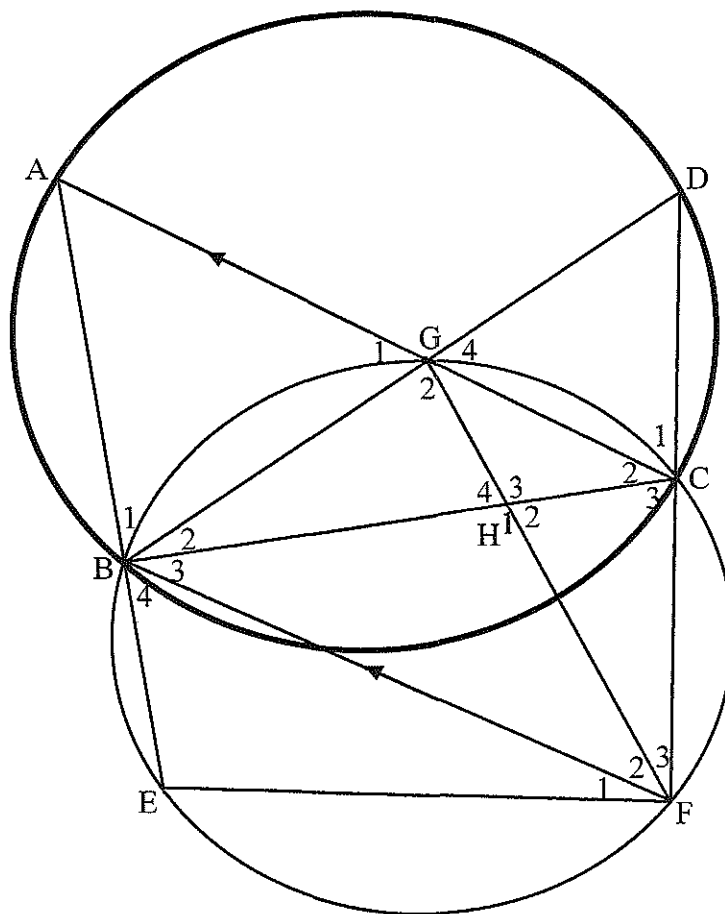


- 9.1 Write, with reasons, THREE angles equal to x . (6)
 - 9.2 Prove that $\hat{O}_2 = 90^\circ - x$ (3)
 - 9.3 Prove that EC is a tangent to the circle passing through points, M, C and O. (4)
 - 9.4 Prove that DOCE is a cyclic quadrilateral. (3)
- [16]



QUESTION 10

In the diagram below, two circles ABCD and BEFCG intersect at B, C and G. AC $\parallel$ BF. AC and BD intersect at G. BC and FG intersect at H.



10.1 Complete the following reasons:

10.1.1 $\hat{G}_1 = \hat{F}_2$

(1)

10.1.2 $\hat{BFD} = \hat{C}_1$

(1)

10.2 Prove that

10.2.1 $BH = FH$

(4)

10.2.2 $\triangle BEF \parallel \triangle DGF$

(3)

10.2.3 $FH \cdot BG = BH \cdot FC$

(4)

TOTAL: [13]
150



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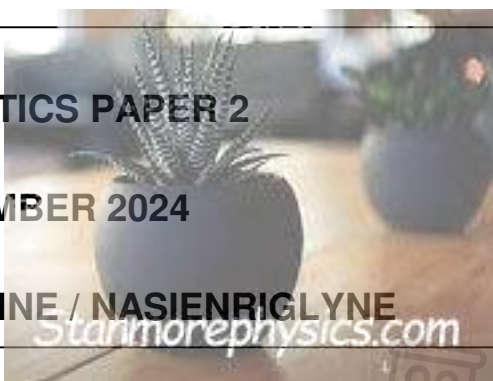
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GRADE 12

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)

NSC Marking Guideline

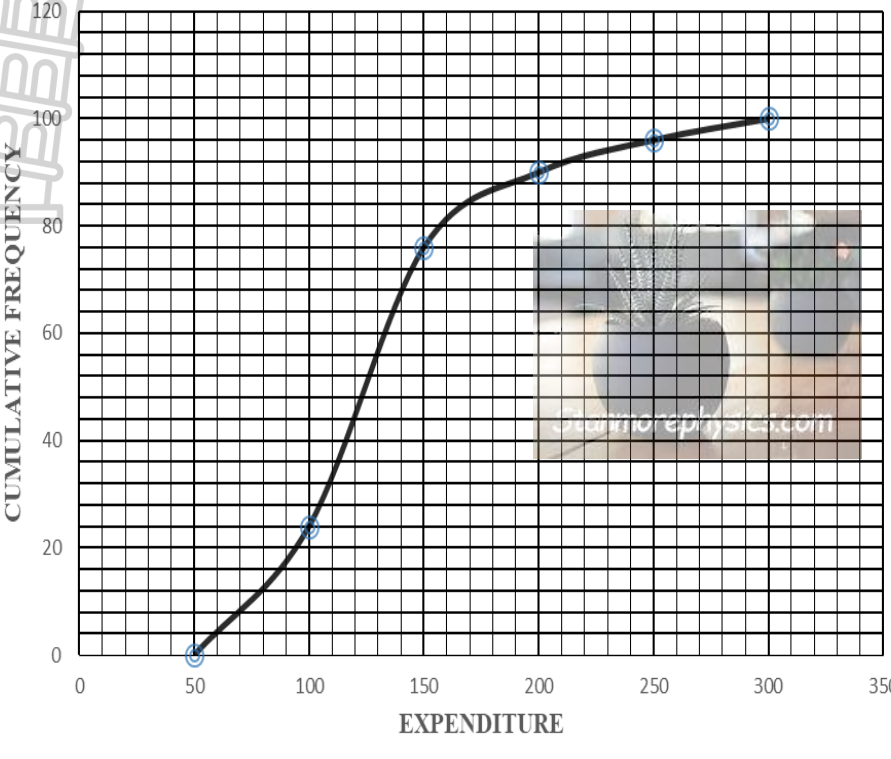
1.5	There's a very strong positive correlation between preparatory marks and final marks. Daar is 'n baie sterk positiewe korrelasie tussen die rekordeksamen en die finale punte.	✓ Answer (1)
1.6	No, the preparatory exam mark is the independent variable. Hence we cannot determine the preparatory mark 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)

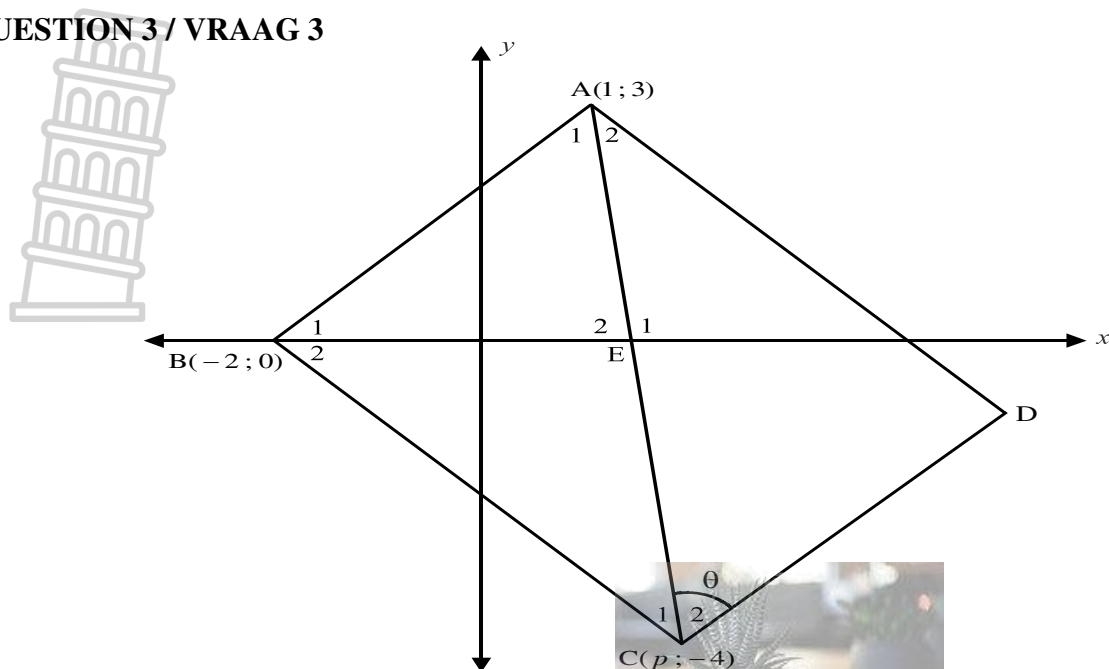


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2.2	Cellphone expenditure for 100 learners. 	✓ Correct points ✓ Grounding ✓ Shape (3)
2.3	$\bar{x} = \frac{(50 \times 24) + (125 \times 52) + (175 \times 14) + (225 \times 6) + (275 \times 4)}{100}$ $= \frac{12600}{100}$ $= 126$	✓ Method ✓ $\div 100$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

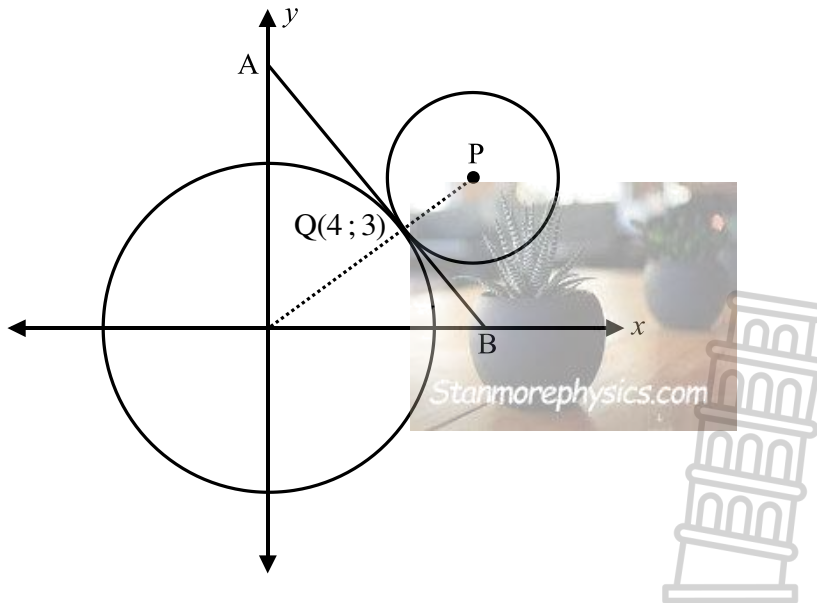
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3.1.4	$D(5; -1)$	✓ $x_D = 5$ ✓ $y_D = -1$ (2)
3.1.5	$\hat{B}_1 + \hat{B}_2 = 90^\circ$ ABCD is a rectangle / reghoek $\therefore AC$ is a diameter / middellyn Centre is the midpoint of AC/Middelpunt van sirkel is middelpunt van AC. $\left(\frac{1+2}{2}; \frac{-4+3}{2}\right) = \left(\frac{3}{2}; -\frac{1}{2}\right)$ 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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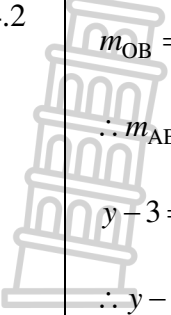
3.2	$3x + by = -2$ $\therefore by = -3x - 2$ $\therefore y = -\frac{3}{b}x - \frac{2}{b}$ $-\frac{3}{b}x - \frac{2}{b} = -\frac{2}{3}x + 2$ $\therefore -9x - 6 = 2bx + 6b$ Substitute $x = -3$: $\therefore -9(-3) - 6 = -2b(-3) + 6b$ $\therefore 27 - 6 = 6b + 6b$ $\therefore 21 = 12b$ $\therefore b = \frac{21}{12} = \frac{7}{4}$	$\checkmark y = -\frac{3}{b}x - \frac{2}{b}$ $\checkmark$ equating equations Stel vergelykings gelyk $\checkmark$ substituting $x = -3$ $\checkmark b = \frac{7}{4}$ (4)
		[24]

QUESTION 4 / VRAAG 4

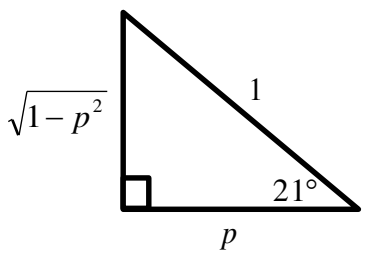
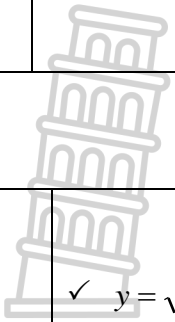


4.1	$x^2 - 12x + y^2 - 9y + 50 = 0$ $\therefore x^2 - 12x + 36 + y^2 - 9y + \frac{81}{4} = -50 + 36 + \frac{81}{4}$ $\therefore (x-6)^2 + \left(y - \frac{9}{2}\right)^2 = \frac{25}{4}$	$\checkmark (x-6)^2$ $\checkmark \left(y - \frac{9}{2}\right)^2$ $\checkmark \frac{25}{4}$ (3)
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4.2	 $m_{OB} = \frac{3}{4}$ $\therefore m_{AB} = -\frac{4}{3}$ $y - 3 = -\frac{4}{3}(x - 4)$ $\therefore y - 3 = -\frac{4}{3}x + \frac{16}{3}$ $y = -\frac{4}{3}x + \frac{25}{3}$	$\checkmark m_{OB} = \frac{3}{4}$ $\checkmark m_{AB} = -\frac{4}{3}$ $\checkmark$ 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	$A\left(0; \frac{25}{3}\right) \quad B\left(\frac{25}{4}; 0\right)$ $\therefore OA = \frac{25}{3} \quad \text{and} \quad OB = \frac{25}{4}$ $\text{Area } \triangle AOB = \frac{1}{2} \times \frac{25}{4} \times \frac{25}{3} = \frac{625}{24} \text{ units}^2$	$\checkmark OA = \frac{25}{3}$ $\checkmark OB = \frac{25}{4}$ $\checkmark$ calculating area (3)
4.5	Q(4; 3) C(-4; 3) $\therefore CQ = 8$ 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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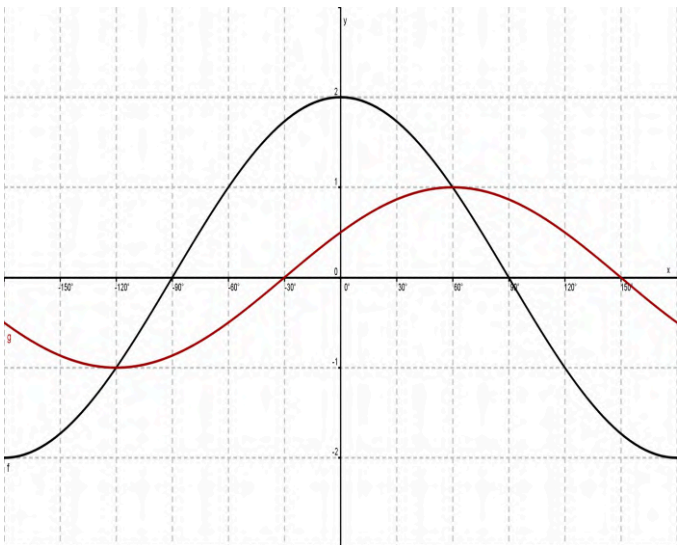
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	$= \frac{\sqrt{1-p^2}}{p}$	
5.1.2	$\begin{aligned}\sin 42^\circ &= \sin 2(21^\circ) \\ &= 2 \sin 21^\circ \cos 21^\circ \\ &= 2(\sqrt{1-p^2})(p) \\ &= 2p\sqrt{1-p^2}\end{aligned}$	✓ $\sin 2(21^\circ)$ ✓ Identity ✓ Answer. (3)
5.1.3	$\begin{aligned}\cos(30^\circ + 21^\circ) &= \cos 30^\circ \cos 21^\circ - \sin 30^\circ \sin 21^\circ \\ &= \frac{\sqrt{3}}{2}(p) - \frac{1}{2}(\sqrt{1-p^2}) \\ &= \frac{p\sqrt{3} - \sqrt{1-p^2}}{2}\end{aligned}$	✓ $\cos(30^\circ + 21^\circ)$ ✓ 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]

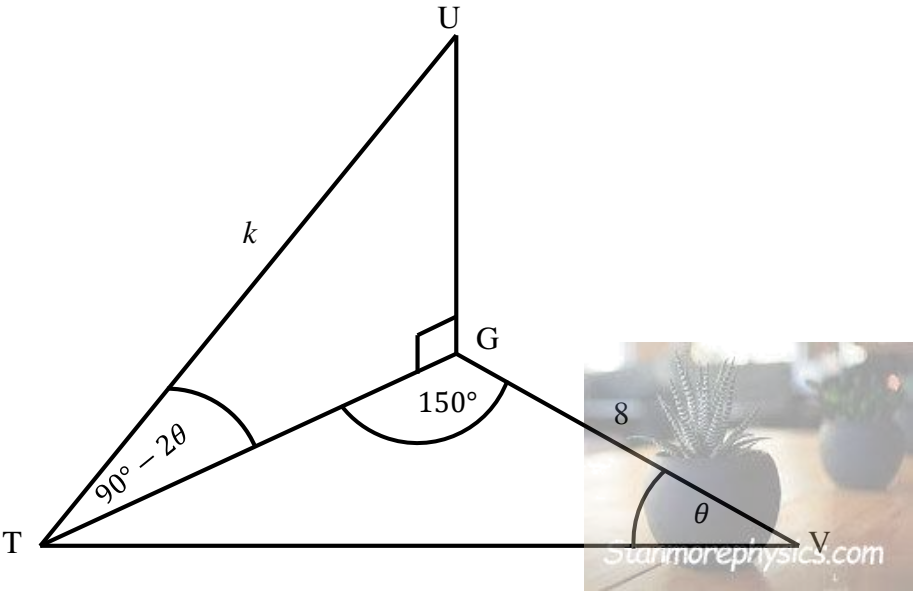
QUESTION 6 / VRAAG 6

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

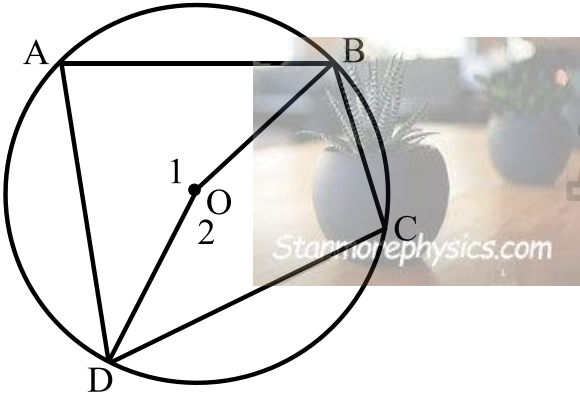


7.1	$\widehat{TUG} = 2\theta$	✓ Answer. (1)
7.2	$\frac{TG}{\sin 2\theta} = \frac{k}{\sin 90^\circ}$ OR $\cos(90^\circ - 2\theta) = \frac{TG}{k}$ $k \sin 2\theta = TG \times 1$ $\therefore TG = k \sin 2\theta$ $\sin 2\theta = \frac{TG}{k}$ $\therefore TG = k \sin 2\theta$	✓ Sine rule. ✓ $\sin 90^\circ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

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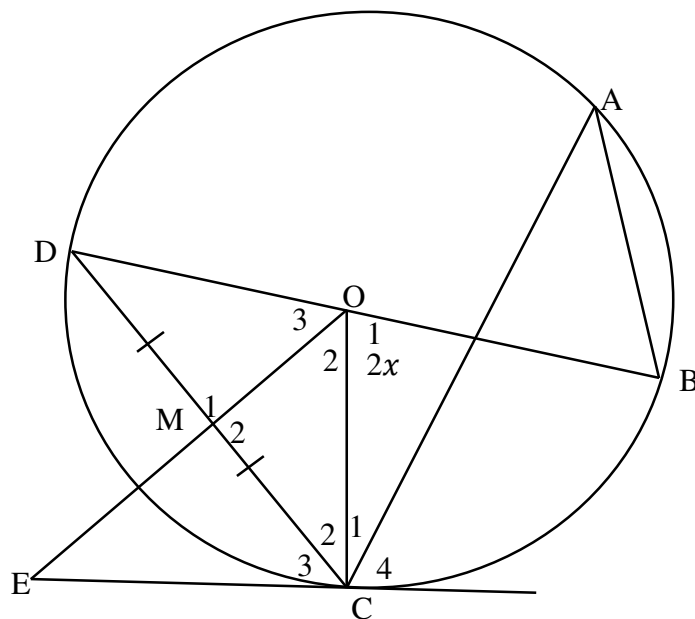
7.3	$\frac{TV}{\sin 150^\circ} = \frac{TG}{\sin \theta}$ $\frac{TV}{\frac{1}{2}} = \frac{TG}{\sin \theta}$ $TV = \frac{\frac{1}{2}TG}{\sin \theta}$ $TV = \frac{\frac{1}{2}(k \sin 2\theta)}{\sin \theta}$ $TV = \frac{\frac{1}{2}(2k \sin \theta \cos \theta)}{\sin \theta}$ $\therefore TV = k \cos \theta$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

QUESTION 8 / VRAAG 8

8.1	 $\hat{O}_1 = 2\hat{C}$ $\hat{O}_2 = 2\hat{A}$ $\angle \text{ at centre} = 2 \times \angle \text{ at circ}$ $\angle \text{ at centre} = 2 \times \angle \text{ at circ}$	$\checkmark \text{ construction}$ $\checkmark \hat{O}_1 = 2\hat{C}$ $\checkmark \hat{O}_2 = 2\hat{A}$
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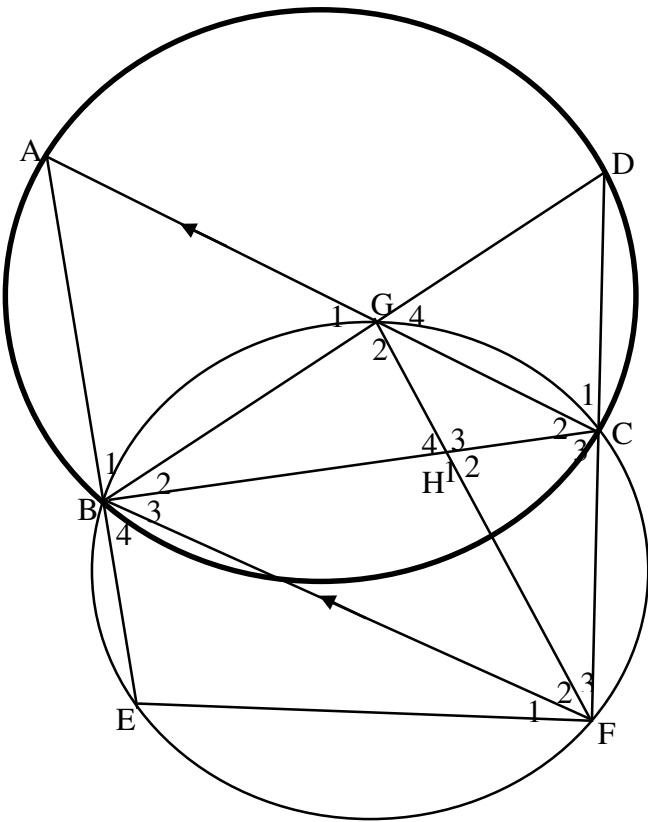
	$\hat{O}_1 + \hat{O}_2 = 2\hat{C} + 2\hat{A}$ $360^\circ = 2\hat{C} + 2\hat{A}$ $\angle$ s round a point $\therefore 180^\circ = \hat{C} + \hat{A}$ $\therefore \hat{A} + \hat{C} = 180^\circ$	✓ Writing the statement $360^\circ = 2\hat{C} + 2\hat{A}$ and hence $\hat{A} + \hat{C} = 180^\circ$ ✓ two correct 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]

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]	✓ S ✓ R ✓ S ✓ R ✓ S ✓ 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 $\triangle$]	✓ S ✓ R ✓ 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.	✓ S ✓ R ✓ S ✓ 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.	✓ S ✓ R ✓ 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 $\triangle$] $\triangle BEF \equiv \triangle DGF$ [$\angle \angle \angle$]	✓ 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
	$\therefore FH.BG = BH.FC$		(4)
			[13]

TOTAL/ TOTAAL:		150
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