basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

MATHEMATICS P2

NOVEMBER 2025

MARKS: 150

TIME: 3 hours

This question paper consists of 14 pages, 1 information sheet and an answer book of 27 pages.

INSTRUCTIONS AND INFORMATION

Read the following instructions and information carefully before answering the questions.

1. This question paper consists of 11 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 your 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. An information sheet with formulae is included at the end of the question paper.
9. Write neatly and legibly.

QUESTION 1

There were 11 cars of the same model for sale at a car dealership. The age (in years) of each car and its corresponding selling price (in rands) is provided in the table below.

AGE OF CAR (IN YEARS)	SELLING PRICE OF CAR (IN RAND)
2	293 000
3	265 000
3	256 000
4	219 000
4	241 000
4	246 000
6	226 000
6	176 000
7	154 000
7	180 000
8	148 000

1.1 Determine the equation of the least squares regression line. (3)

1.2 Predict the selling price of a similar car at this car dealership that is 5 years old. (2)

1.3 Use the correlation coefficient to show whether the prediction made in QUESTION 1.2 is valid or not. (2)

1.4 Use the answer to QUESTION 1.1 to write down the estimated average yearly decrease in the selling price of these 11 cars. (1)
[8]

QUESTION 2

2.1 The cumulative frequency table below shows the amount of time that people spent on a particular website on a certain day.

TIME, t (IN MINUTES)	CUMULATIVE FREQUENCY
$0 < t \leq 20$	16
$0 < t \leq 40$	40
$0 < t \leq 60$	59
$0 < t \leq 80$	67
$0 < t \leq 100$	70

2.1.1 How many people visited this website on that day? (1)

2.1.2 How many people spent more than 40 and up to 80 minutes on the website? (2)

2.1.3 Draw a histogram to represent the information provided in the cumulative frequency table. (3)

2.1.4 Comment on the skewness of the data. (1)

2.2 There are 9 players in a basketball team. The coach calculated that on average, each player scored 12 points during a game. The points scored by 8 of the 9 players from the team is given below:

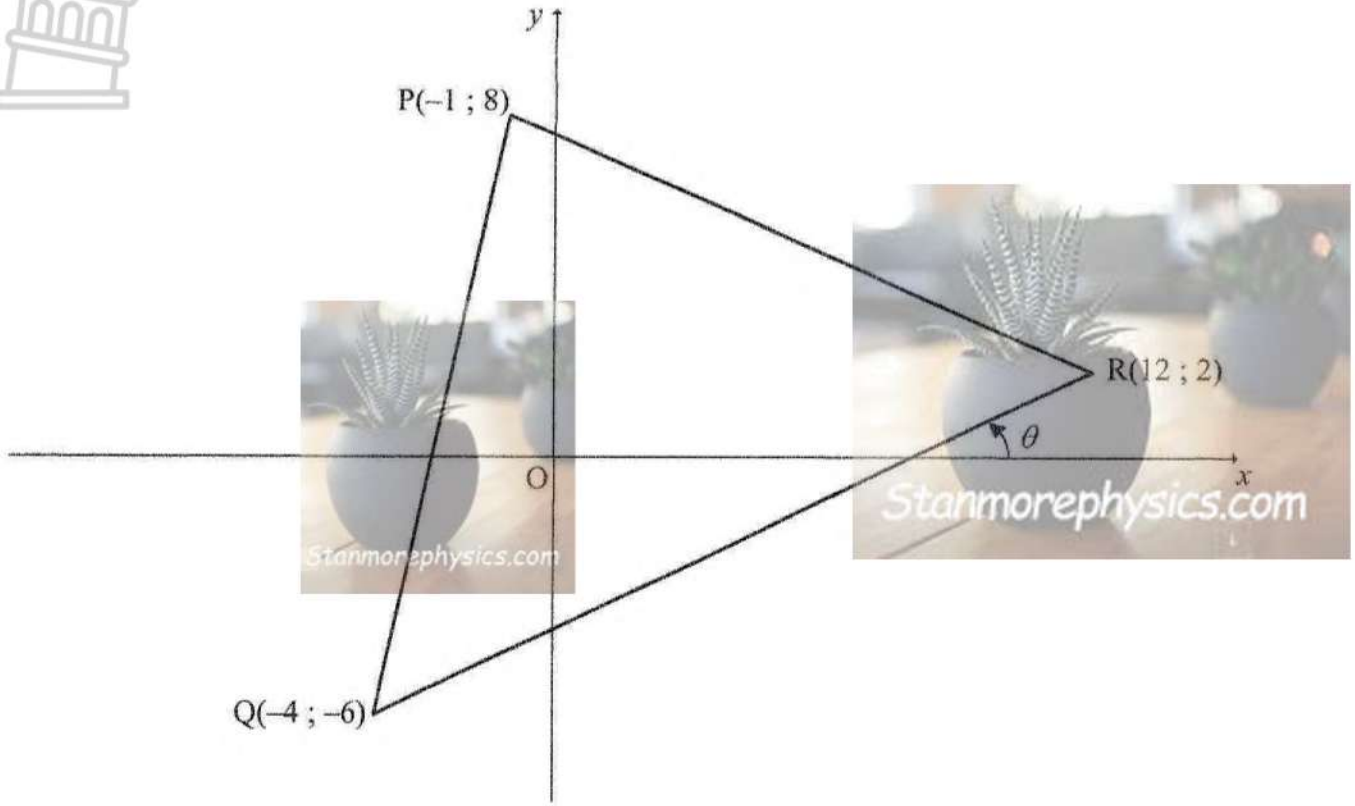
11	14	19	20	8	10	2	14

How many players' points score was outside ONE standard deviation of the mean points score? (5)

[12]

QUESTION 3

In the diagram, P(–1 ; 8), Q(–4 ; –6) and R(12 ; 2) are the vertices of ΔPQR. The angle of inclination of QR is θ.



3.1 Calculate the length of QR. Leave your answer in simplified surd form. (2)

3.2 Calculate the gradient of QR. (2)

3.3 Calculate the size of θ. (2)

3.4 Determine the equation of QR. (2)

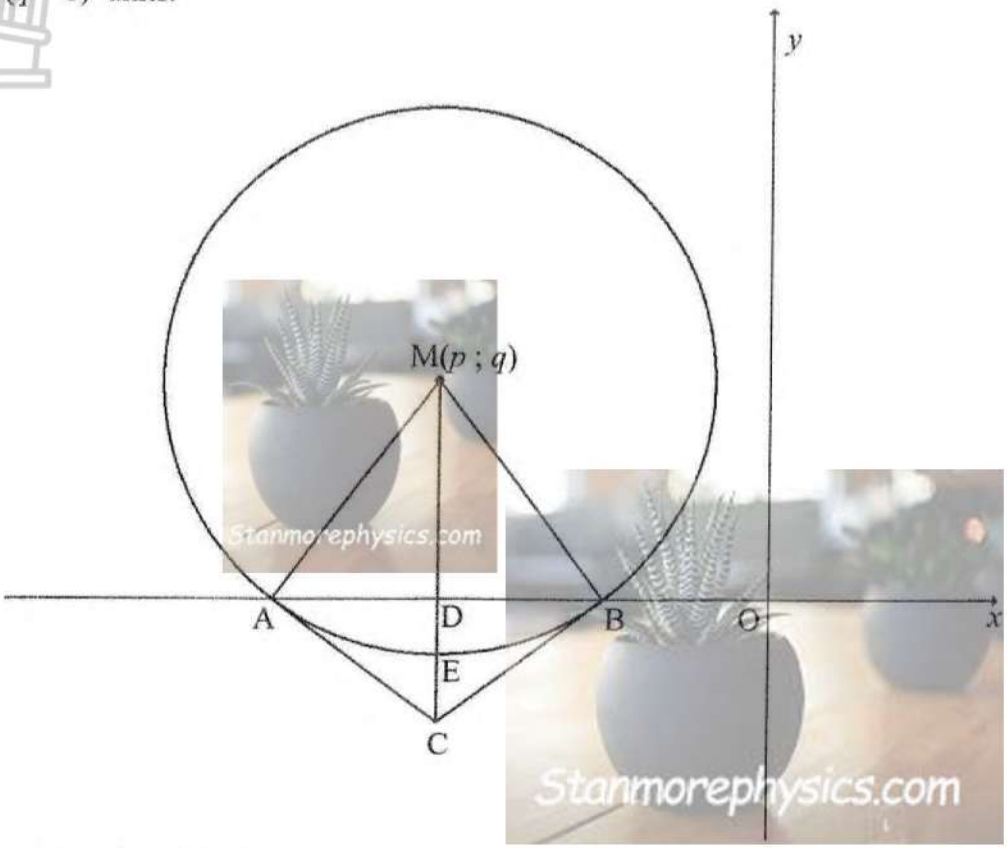
3.5 PQRS, in that order, is a parallelogram. Write down the coordinates of S. (2)

3.6 T is a point on QR such that PT ⊥ QR. Calculate the coordinates of T. (5)

3.7 Calculate the area of parallelogram PQRS. (3)
[18]

QUESTION 4

In the diagram, M$(p\ ;\ q)$ is the centre of the circle that intersects the x-axis at A and B. C is a point such that the line drawn from M to C is parallel to the y-axis and intersects the x-axis at D. MC intersects the circle at E$(-6\ ;\ -1)$. Tangents drawn from C touch the circle at A and B. AD $= (q - 1)$ units.



4.1 Write down the value of p. (1)

4.2 Show that $q = 4$. (4)

4.3 Determine the equation of the circle in the form $(x-a)^2+(y-b)^2=r^2$. (2)

4.4 If the circle is translated 2 units to the left, determine the minimum distance between the circle and the y-axis. (1)

4.5 Calculate the coordinates of A and B. (3)

4.6 Determine the equation of tangent BC. (4)

4.7 Write down the coordinates of C. (2)

4.8 Calculate the size of $A\hat{C}B$. (4)
[21]

QUESTION 5

5.1 It is given that $\tan 50° = k$. Express EACH of the following in terms of k:

5.1.1 $\cos 40°$ (2)

5.1.2 $\dfrac{2\sin 25°.\cos 25°}{-2+4\sin^2 25°}$ (5)

5.1.3 $\sin 10°$ (4)

5.2 Given: $\dfrac{\sin(540°+x).\cos(90°+x)}{\sin(-x)}$

5.2.1 Simplify the expression above fully to a single trigonometric ratio. (4)

5.2.2 Hence, determine the values of x in the interval $x \in [0°;360°]$ for which $\sqrt{\dfrac{\sin(540°+x).\cos(90°+x)}{\sin(-x)}}$ will be real. (2)

[17]

QUESTION 6

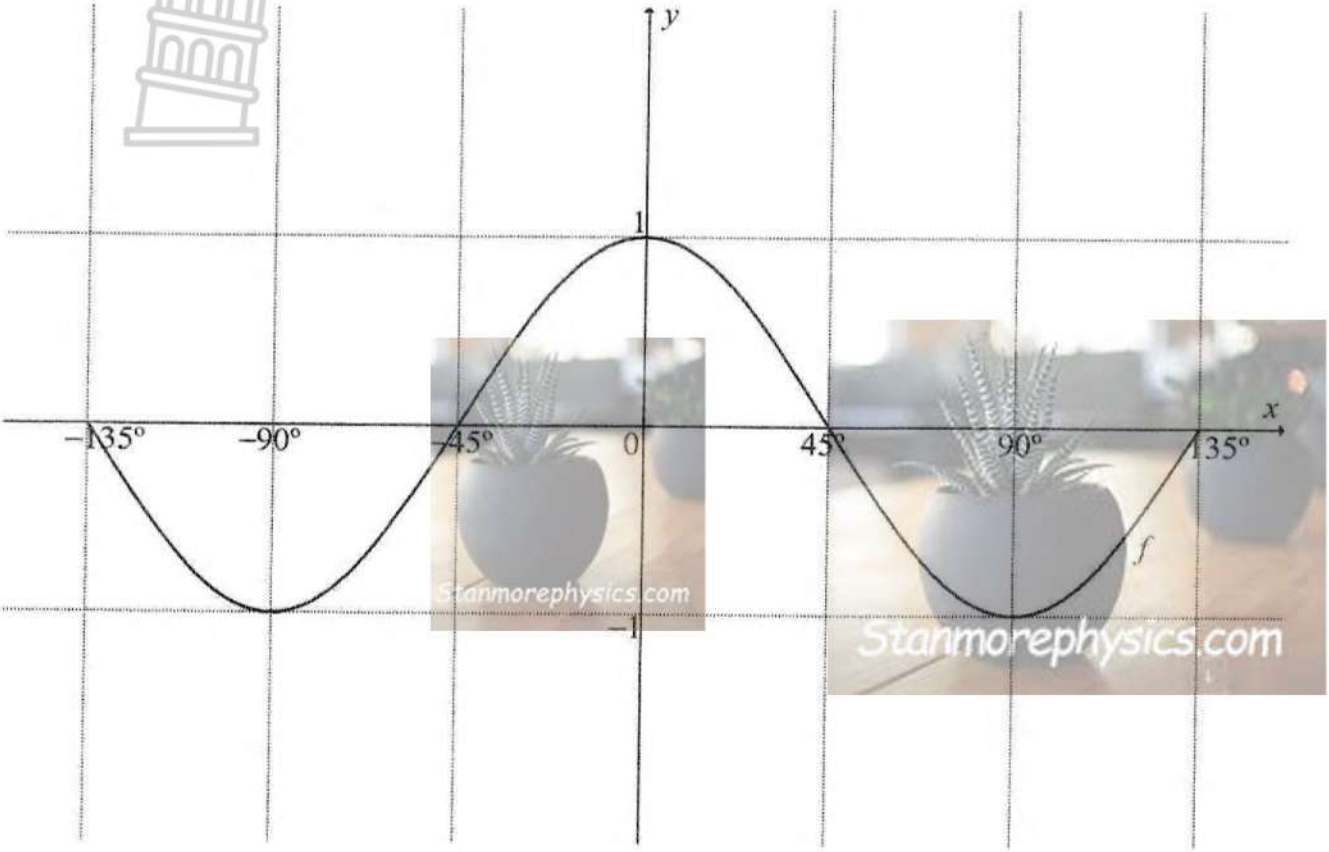
6.1 Prove that: $[\tan(180°-x)](1-\cos^2 x)+\cos^2 x = \dfrac{(\sin x-\cos x)(1+\sin x.\cos x)}{-\cos x}$ (6)

6.2 It is given that $\sin^2 x$; $\cos^2 x$ and $\frac{1}{2}\sin 2x$ are the first three terms of an arithmetic sequence. The constant difference of the arithmetic sequence is NOT zero.
Determine the general solution for x. (7)

[13]

QUESTION 7

In the diagram, the graph of $f(x) = \cos 2x$ is drawn for $x \in [-135° ; 135°]$.



7.1 Write down the period of f. (1)

7.2 On the set of axes provided in the ANSWER BOOK, draw the graph of $g(x) = \tan 2x - 1$ for $x \in [-135° ; 135°]$. (3)

7.3 Graph f is translated $45°$ to the left to form graph h. Determine the equation of h in its simplest form. (1)

7.4 Write down the range of h. (1)

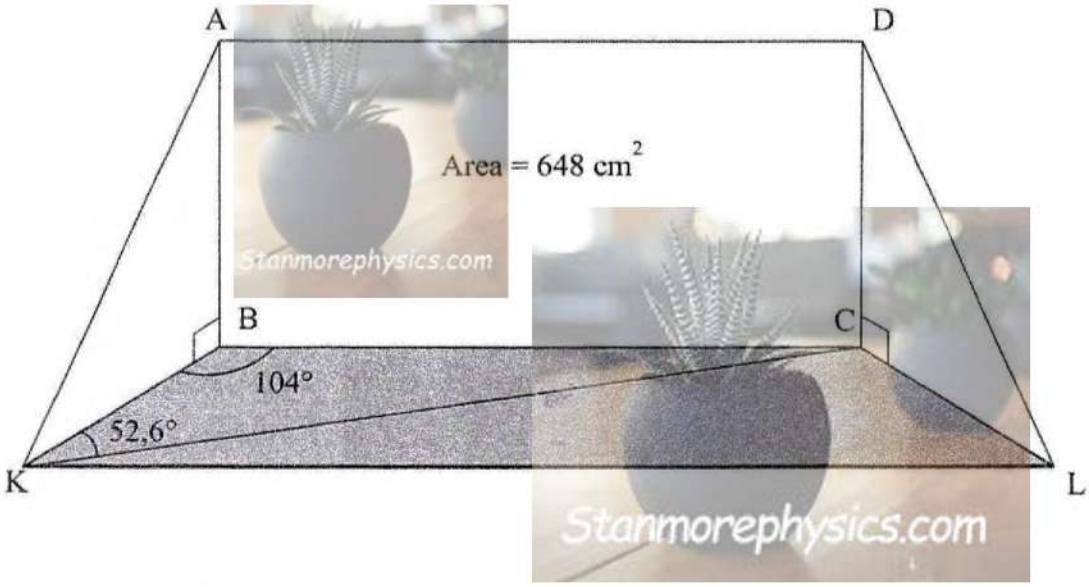
7.5 Determine the values of x for which $(1 - \tan 2x)(\cos 2x) \geq 0$ in the interval $x \in [0° ; 135°]$. (4)

[10]

QUESTION 8

As part of a school project, learners are required to design a portable stage for a puppet show, as shown in the diagram below. The design must fulfil the following requirements:

- BKLC is a horizontal base having $K\hat{B}C = 104°$ and $B\hat{K}C = 52,6°$.
- The rectangular backdrop, ABCD, is vertical to the horizontal base and must have an area of 648 cm^2.
- The sides of ABCD must be in the ratio AB : BC = 1 : 2.
- The stage must be partly enclosed with triangular sides ABK and DCL.



8.1 Show that AB = 18 cm. (2)

8.2 Calculate the length of AC. (2)

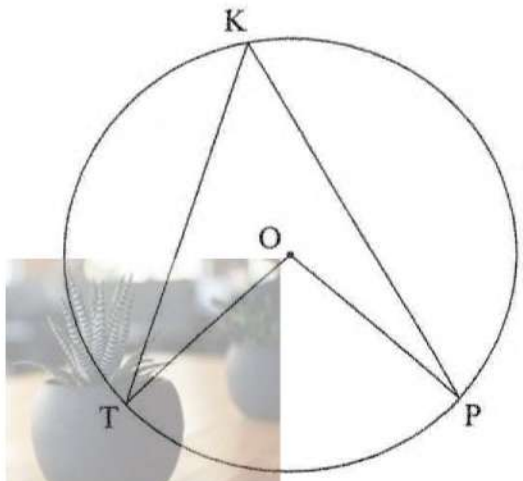
8.3 Calculate the length of diagonal KC. (2)

8.4 If AB = BK, calculate the size of $K\hat{A}C$. (4)
[10]

Provide reasons for your statements in QUESTIONS 9, 10 and 11.

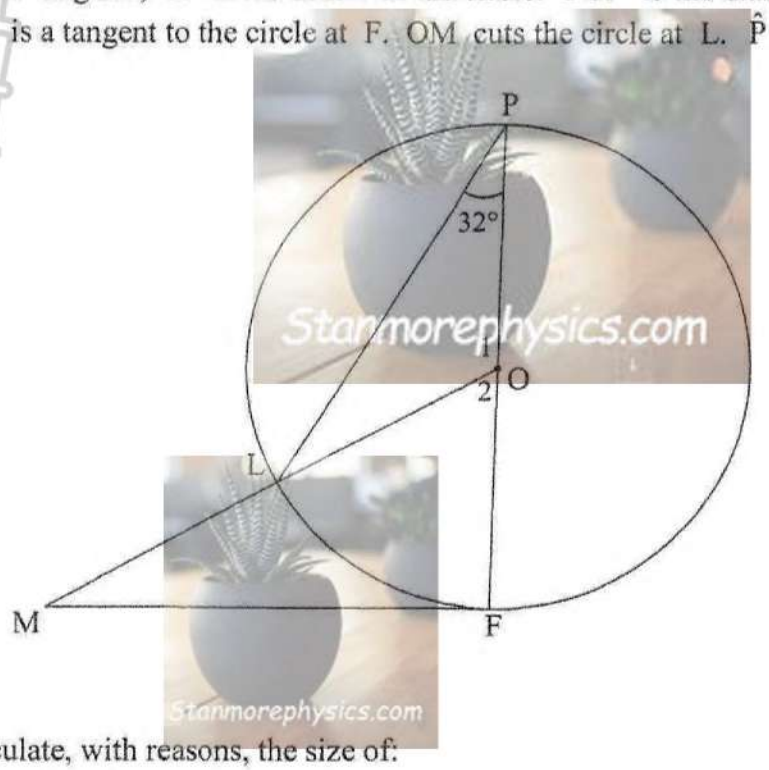
QUESTION 9

9.1 In the diagram, O is the centre of the circle. K, T and P lie on the circle.



Use the diagram above to prove the theorem which states that the angle subtended by a chord (or arc) at the centre of the circle is equal to twice the angle subtended by the same chord (or arc) at the circumference, that is prove that $T\hat{O}P = 2\,T\hat{K}P$. (5)

9.2 In the diagram, O is the centre of the circle. POF is the diameter of the circle and MF is a tangent to the circle at F. OM cuts the circle at L. $\hat{P} = 32°$.



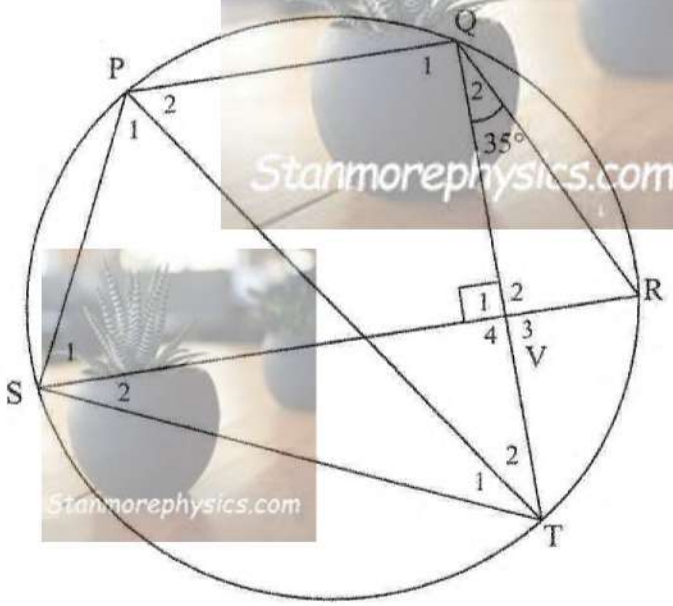
Calculate, with reasons, the size of:

9.2.1 $\hat{O}_2$ (2)

9.2.2 $\hat{M}$ (3)
[10]

QUESTION 10

In the diagram, PQRS is a cyclic quadrilateral. T is a point on the circle such that QT is perpendicular to SR at V. PT and ST are drawn. $\hat{Q}_2 = 35°$ and $\hat{R} = \hat{S}_1$.



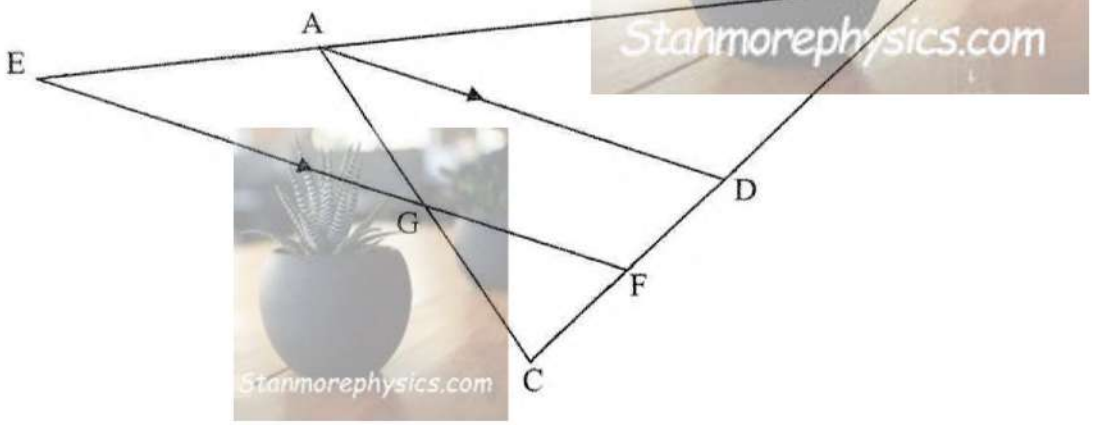
10.1 Calculate, with reasons, the size of $Q\hat{T}S$. (3)

10.2 Prove that PQ || SR. (3)

10.3 Prove that PT is a diameter of the circle. (2)
[8]

QUESTION 11

11.1 In the diagram, ΔABC is drawn. BA is produced to E. F and D are points on BC such that AD || EF. AC and EF intersect at G. $\frac{CF}{FB}=\frac{2}{5}$ and $\frac{CG}{GA}=\frac{3}{2}$.



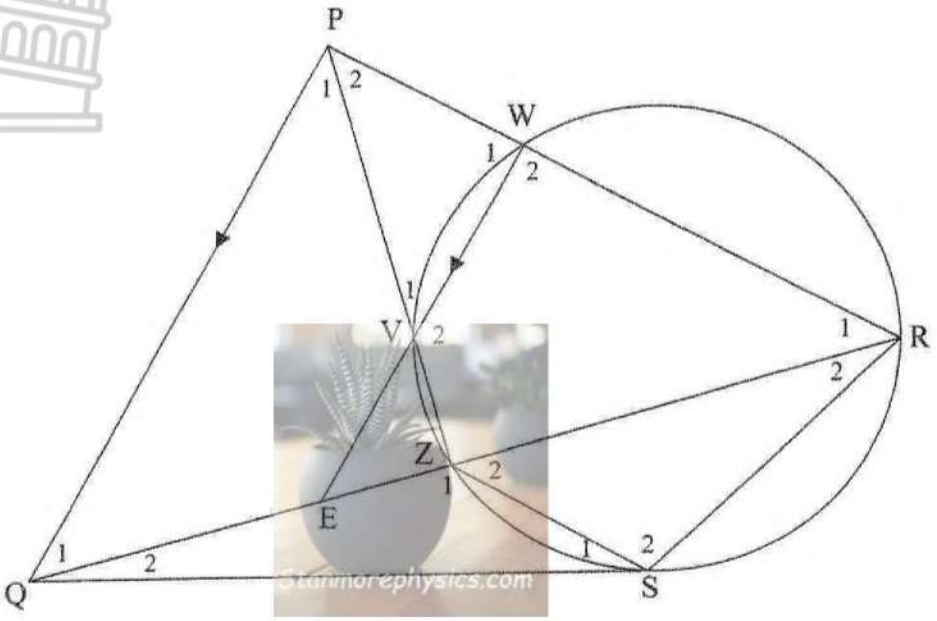
Calculate, with reasons, the value of:

11.1.1 $\frac{FD}{CF}$ (2)

11.1.2 $\frac{BA}{EA}$ (4)

11.1.3 $\frac{\text{Area of } \Delta GCF}{\text{Area of GFDA}}$ (4)

11.2 In the diagram, WVZR is a cyclic quadrilateral. RZ is produced to Q. A tangent is drawn from Q to touch the circle at S. WV is produced to E, a point on ZQ. RW produced meets ZV produced in P. PQ || WE. RS and ZS are drawn.



Prove, with reasons, that:

11.2.1 $PR = \dfrac{PW.QR}{QE}$ (2)

11.2.2 If $\Delta PQZ \,|||\, \Delta RQP$, then $PQ^2 = RQ.QZ$ (1)

11.2.3 $\Delta QSZ \,|||\, \Delta QRS$ (3)

11.2.4 $PQ = QS$ (3)

11.2.5 $PW = \dfrac{QE.PZ}{\sqrt{QR.QZ}}$ (4)

[23]

TOTAL: 150

INFORMATION SHEET

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$A = P(1+ni)$ $\quad A = P(1-ni)$ $\quad A = P(1-i)^n$ $\quad A = P(1+i)^n$

$T_n = a + (n-1)d$ $\quad S_n = \frac{n}{2}[2a + (n-1)d]$

$T_n = ar^{n-1}$ $\quad S_n = \frac{a(r^n - 1)}{r-1}$; $r \neq 1$ $\quad S_\infty = \frac{a}{1-r}$; $-1 < r < 1$

$F = \frac{x[(1+i)^n - 1]}{i}$ $\quad P = \frac{x[1-(1+i)^{-n}]}{i}$

$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $\quad M\left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2}\right)$

$y = mx + c$ $\quad y - y_1 = m(x - x_1)$ $\quad m = \frac{y_2 - y_1}{x_2 - x_1}$ $\quad m = \tan\theta$

$(x-a)^2 + (y-b)^2 = r^2$

In ΔABC: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

$a^2 = b^2 + c^2 - 2bc.\cos A$

area $\Delta ABC = \frac{1}{2}ab.\sin C$

$\sin(\alpha + \beta) = \sin\alpha.\cos\beta + \cos\alpha.\sin\beta$ $\quad \sin(\alpha - \beta) = \sin\alpha.\cos\beta - \cos\alpha.\sin\beta$

$\cos(\alpha + \beta) = \cos\alpha.\cos\beta - \sin\alpha.\sin\beta$ $\quad \cos(\alpha - \beta) = \cos\alpha.\cos\beta + \sin\alpha.\sin\beta$

$$\cos 2\alpha = \begin{cases} \cos^2\alpha - \sin^2\alpha \\ 1 - 2\sin^2\alpha \\ 2\cos^2\alpha - 1 \end{cases}$$

$\sin 2\alpha = 2\sin\alpha.\cos\alpha$

$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$ $\quad \sigma^2 = \frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n}$

$P(A) = \frac{n(A)}{n(S)}$ $\quad P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

$\hat{y} = a + bx$ $\quad b = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sum (x - \bar{x})^2}$

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NATIONAL SENIOR CERTIFICATE/ *NASIONALE SENIOR SERTIFIKAAT*

GRADE 12/*GRAAD 12*

MATHEMATICS P2/*WISKUNDE V2*

NOVEMBER 2025

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

APPROVED
DEPUTY CHIEF EXAMINER
11/11/2025

These marking guidelines consist of 26 pages./
Hierdie nasienriglyne bestaan uit 26 bladsye.

DEPARTMENT OF BASIC EDUCATION
2025 -11- 12
APPROVED MARKING GUIDELINE

Approved
Quantum
DBE IM
11/11/2025

Approved
2025-11-11

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, 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

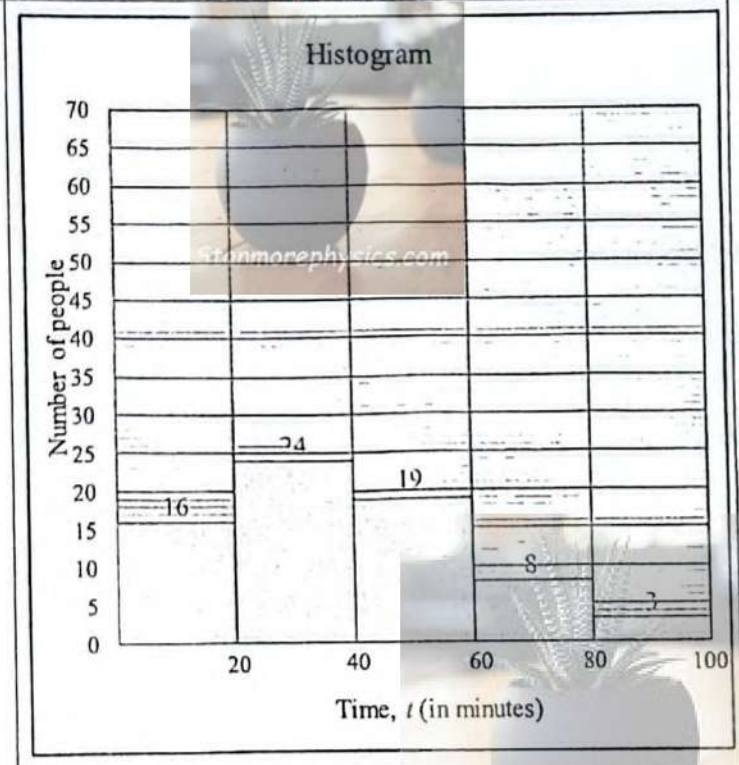
QUESTION/*VRAAG* 1

AGE OF CAR (IN YEARS)	SELLING PRICE OF CAR (IN RANDS)
2	293 000
3	265 000
3	256 000
4	219 000
4	241 000
4	246 000
6	226 000
6	176 000
7	154 000
7	180 000
8	148 000

1.1	$a = 331\,397{,}20$ ✓ $b = -22\,988{,}32$ ✓ $\hat{y} = 331\,397{,}20 - 22\,988{,}32x$ ✓ If a & b are wrong, but subs correctly: 1 (CA) AO: FM / AO but swapped: 1 mark.	✓ $a = 331\,397{,}20$ ✓ $b = -22\,988{,}32$ ✓ equation (3)
1.2	$\hat{y} = 331\,397{,}20 - 22\,988{,}32(5)$ ✓ $= 216\,455{,}60$ ✓ CA **OR/*OF*** $\hat{y} = 216\,455{,}61$ (calculator) ✓✓	✓ substitution ✓ answer (2) ✓✓ answer (2)
1.3	The strong correlation ($r = -0{,}95$) ✓ suggests that the data points lie close to the regression line. Therefore, the prediction will be valid. ✓ If r is not shown credit strong/effel and answer ✓ *'n Sterk korrelasie ($r = -0{,}95$) dui aan dat die punte naby aan die regressielyn lê.* *Dus, die voorspelling is geldig.*	✓ strong correlation **OR** $r = -0{,}95$ ✓ answer (2)
1.4	The average decrease per year is R22 988,32. ✓ answer *Die gemiddelde afname per jaar is* R 22 988,32. Credit -22 988,32 CA from 1.1.	(1)
		[8]

QUESTION/*VRAAG* 2

TIME, t (IN MINUTES)	CUMULATIVE FREQUENCY
$0 < t \leq 20$	16
$0 < t \leq 40$	40
$0 < t \leq 60$	59
$0 < t \leq 80$	67
$0 < t \leq 100$	70

2.1.1	70 ✓	✓ 70 (1)
2.1.2	No. of people = 67 – 40 ✓ OR 19+8 = 27 = 27 ✓ AD: FM	✓ 67 – 40 ✓ 27 (2)
2.1.3		✓ two frequencies correct ✓ all frequencies correct ✓ no gaps between bars If CF used: max 1 1 mark if freq are wrong but bars are joined. (3)
2.1.4	Skewed to the right **OR** positively skewed *Skeef na regs* **OF** *positief skeef*	✓ answer (1)

2.1.4 will always be wrong if the candidate used a CF in 2.1.3.

CA

2.2

11	14	19	20	8	10	2	14

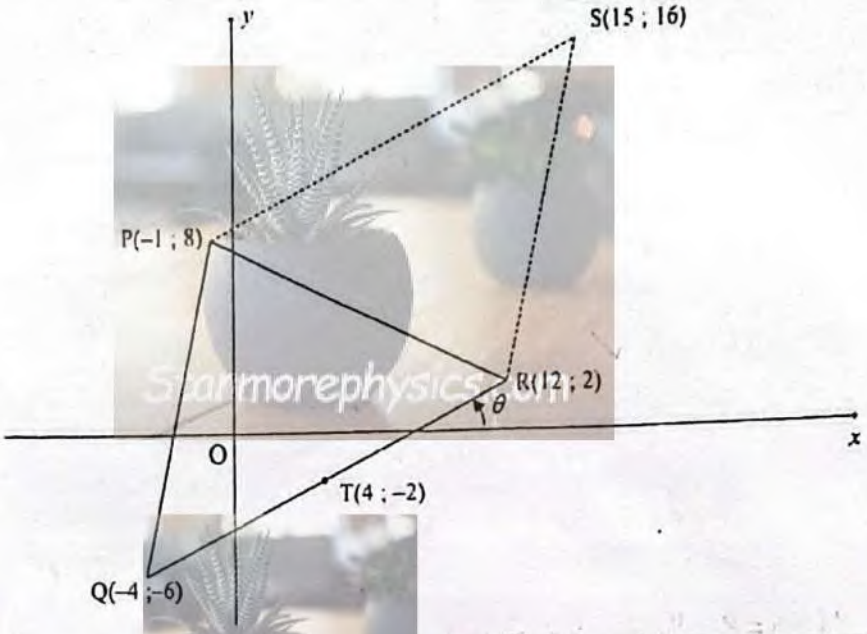
	$\frac{11+14+19+20+8+10+2+14+x}{9} = 12$ ✓ $x+98 = 108$ $x = 10$ ✓ The 9th player scored 10 points	✓ equating using mean ✓ answer
	$\sigma = 5{,}23$ ✓ (5,22812) $(\bar{x}-\sigma\,;\bar{x}+\sigma) = (12-5{,}23;12+5{,}23)$ ✓ $=(6{,}77;17{,}23)$ ✓ 3 players' points were outside one standard deviation of the mean. 3 *spelers se punte aangeteken lê buite een standaardafwyking van die gemiddeld.*	✓ standard deviation ✓ interval ✓ answer (5)
		[12]

(1) If $n=8$, then $\sigma = 5{\cdot}49$
$\bar{x} = 12{\cdot}25$
(6.76 ; 17.74) ✓
3 players ✓

(2) If $n=8$ then $\sigma = 5{\cdot}49$
and $\bar{x} = 12$
(6,51 ;) ✓
3 players ✓

(3) AO: 1

QUESTION/*VRAAG* 3

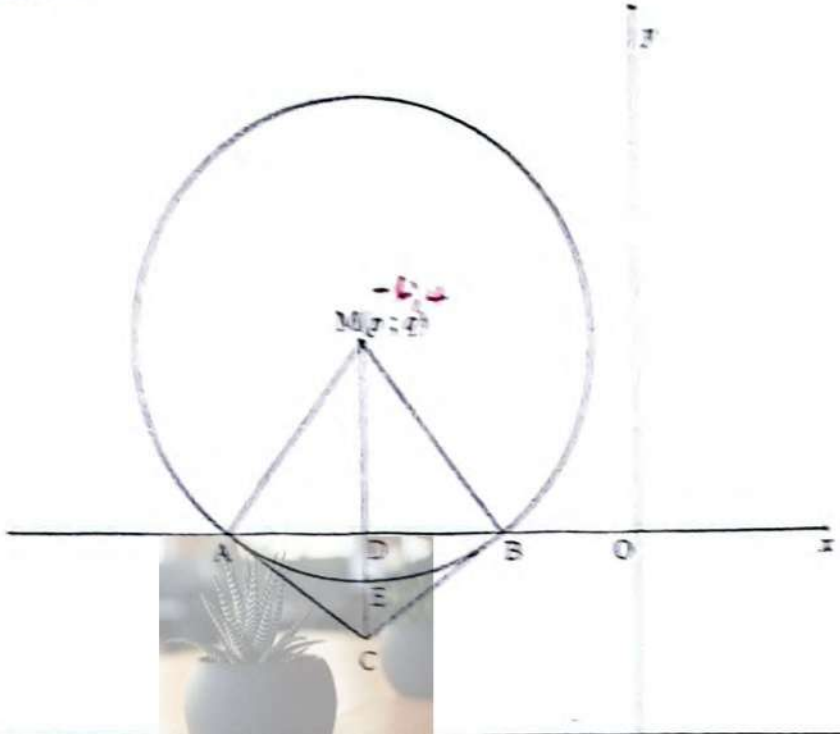


3.1	$QR=\sqrt{(-4-12)^2+(-6-2)^2}$ Ans in surd $\sqrt{320}$ or $8\sqrt{5}$ or dec $=\sqrt{320}=8\sqrt{5}$ units	✓ $QR=\sqrt{(-4-12)^2+(-6-2)^2}$ ✓ answer AO: FM (2)
3.2	$m_{QR}=\frac{-6-2}{-4-12}$ OR $m_{QR}=\frac{2-(-6)}{12-(-4)}$ $\frac{x}{y}$ BA $m_{QR}=\frac{1}{2}$ $m_{QR}=\frac{1}{2}$ If values are swapped:	✓ correct substitution of Q(–4 ; –6) & R(12 ; 2) into gradient formula ✓ answer AO: FM (2)
3.3	$m_{QR}=\frac{1}{2}$ CA $\tan\theta=\frac{1}{2}$ ✓ $\theta=26{,}57°$ ✓ AO: FM	✓ $\tan\theta=m_{QR}$ ✓ answer (2)
3.4	$m_{QR}=\frac{1}{2}$ CA $-6=\frac{1}{2}(-4)+c$ OR $y-2=\frac{1}{2}(x-12)$ $c=-4$ $y-2=\frac{1}{2}x-6$ $y=\frac{1}{2}x-4$ $y=\frac{1}{2}x-4$	✓ correct substitution of gradient and point Q(–4 ; –6) or R(12 ; 2) ✓ answer (2)
3.5	$Q\rightarrow R:(x;y)\rightarrow(x+16;y+8)$ $\therefore S(15;16)$	✓ $x_S=15$ ✓ $y_S=16$ (2)

3.6	$m_{QR} = \frac{1}{2}$ $m_{PT} = -2$ ✓ Equation of PT: $y = -2x + c$ $8 = -2(-1) + c$ **OR** $c = 6$ $y = -2x + 6$ ✓ $-2x + 6 = \frac{1}{2}x - 4$ ✓ $-4x + 12 = x - 8$ ✓ $5x = 20$ $x = 4$ $y = \frac{1}{2}(4) - 4$ $y = -2$ $T(4;-2)$ ✓ **OR** $PQ = \sqrt{(-4-(-1))^2 + (-6-8)^2} = \sqrt{205}$ $PR = \sqrt{(12-(-1))^2 + (2-8)^2} = \sqrt{205}$ $\therefore$ ΔPQR is isosceles / ΔPQR *is 'n gelykbenige* Δ $\therefore$ $\perp$ height bisects the base QR / $\perp$ *hoogte halveer die basis* QR $\therefore$ T is midpoint of QR / T *is middelpunt van* QR $\therefore T(4;-2)$	✓ m_{PT} ✓ equation of PT ✓ equation QR = equation PT. ✓ simplification Assuming that T is the midp of QR; $\left(\frac{x_1+x_2}{2}; \frac{y_1+y_2}{2}\right)$ ✓ ✓ $T(x_T; y_T)$ (5) AO: $\frac{1}{5}$; Assuming ISA Δ: $\frac{1}{5}$ ✓ $PQ = \sqrt{205}$ ✓ $PR = \sqrt{205}$ ✓ ΔPQR is isosceles ✓ $\perp$ height bisects the base QR ✓ $T(4;-2)$ (5)
3.7	$PT = \sqrt{(4-(-1))^2 + (-2-8)^2}$ $PT = \sqrt{125} = 5\sqrt{5}$ units $= 11{,}18$ units ✓ Area of PQRS = QR.PT $= (8\sqrt{5})(5\sqrt{5})$ ✓ $= 200$ units^2 ✓ **OR** Shoe-lace accepted. CA only if $\frac{1}{2}bL$ or bh is used.	✓ length of PT ✓ substitution of QR and PT ✓ answer (3)

	$PT = \sqrt{(4-(-1))^2+(-2-8)^2}$ $PT = \sqrt{125} = 5\sqrt{5}$ units $= 11{,}18$ units	✓ length of PT
	Area of $\Delta PQR = \frac{1}{2}(8\sqrt{5})(5\sqrt{5})$ $= 100$ units^2	✓ substitution of QR and PT
	Area of PQRS $= 2\times$ Area of ΔPQR $= 200$ units^2	✓answer (3)
		[18]

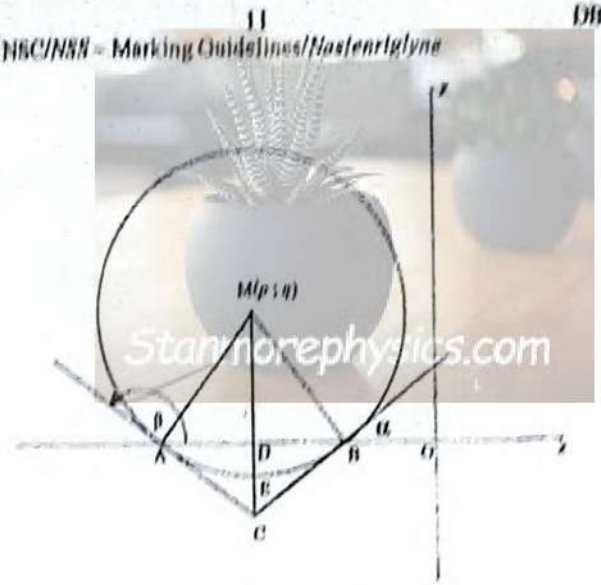
QUESTION 4/VRAAG 4



4.1	$y=-6$ ✓		✓ $y=-6$ (1)
4.2	$M\hat{D}B=90^\circ$ $AM=ME=q+1$ $MD=q$	[MC ⊥ y-axis] [radii]	✓ $AM=q+1$ ✓ $MD=q$
	$AM^2=AD^2+MD^2$ $(q+1)^2=(q-1)^2+q^2$ $q^2+2q+1=q^2-2q+1+q^2$ $q^2-4q=0$ $q(q-4)=0$ $q\neq 0$ or $q=4$	[Pythagoras]	✓ substitution into Pythagoras ✓ standard form (4)
4.3	$AM=5$ units ✓ $(x+6)^2+(y-4)^2=25$ ✓	CA from 4.1 & 4.2	✓ LHS ✓ RHS (2)
4.4	3 units ✓	$6-4+2$	✓ answer (1)

4.5	$(x+6)^2+(0-4)^2=25$ ✓ $(x+6)^2=9$ $x+6=3$ or $x+6=-3$ $x=-3$ $x=-9$ A(−9 ; 0) ✓ B(−3 ; 0) ✓ CA from 4.3 Credit even if A and B are not named (labled) **OR** $(x+6)^2+(0-4)^2=25$ $x^2+12x+36+16-25=0$ $x^2+12x+27=0$ $(x+3)(x+9)=0$ $x=-3$ or $x=-9$ A(−9 ; 0) B(−3 ; 0) Credit even if there are no coordinates i.e. $x=-3$ or $x=-9$ **OR** $q-1=3$ DB = AD = 3 A(−9 ; 0) B(−3 ; 0) [line from centre ⊥ to chord/ *lyn vanuit midpt ⊥ op koord*]	✓ substituting $y=0$ into equation of circle ✓ coordinates of A ✓ coordinates of B (3) ✓ substituting $y=0$ into equation of circle ✓ coordinates of A ✓ coordinates of B (3) ✓ DB = 3 ✓ coordinates of A ✓ coordinates of B (3)
4.6	$m_{MB}=\frac{4-0}{-6-(-3)}$ $=-\frac{4}{3}$ $m_{BC}=\frac{3}{4}$ $y=\frac{3}{4}x+c$ $0=\frac{3}{4}(-3)+c$ $c=\frac{9}{4}$ $y=\frac{3}{4}x+\frac{9}{4}$ OR $y-y_1=\frac{3}{4}(x+x_1)$ $y-0=\frac{3}{4}[x-(-3)]$ $y=\frac{3}{4}(x+3)$ $y=\frac{3}{4}x+\frac{9}{4}$	✓ m_{MB} ✓ m_{BC} ✓ substitution of gradient BC and coordinates of B ✓ answer (4)
4.7	$C\left(-6;-\frac{9}{4}\right)$ CA from 4.1 & 4.6	✓ x_C ✓ y_C (2)

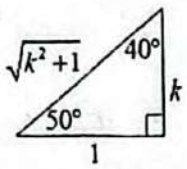
3/4 if wrong grad is used.



4.8	$\tan\alpha = \frac{3}{4}$ $\alpha = 36{,}87°$ ✓	✓ $\alpha = 36{,}87°$
	$m_{AC} = -\frac{3}{4}$ $\tan\beta = -\frac{3}{4}$ ✓ $\beta = 180° - 36{,}87°$ $\beta = 143{,}13°$ ✓ $\therefore A\hat{C}B = 106{,}26°$ ✓	✓ $\tan\beta = m_{AC}$ ✓ value of β ✓ answer (4)
	OR $\tan M\hat{A}B = m_{MA} = \frac{4}{3}$ $M\hat{A}B = 53{,}13°$ $A\hat{M}D = 90° - 53{,}13°$ $A\hat{M}D = 36{,}87°$ $M\hat{A}C = 90°$ [tangent ⊥ radius / *raaklyn⊥radius*] $A\hat{C}M = 53{,}13°$ $\therefore A\hat{C}B = 106{,}26°$ [property of kite /*eienskappe van vlieër*]	✓ $M\hat{A}B$ ✓ $A\hat{M}D$ ✓ $A\hat{C}M$ ✓ answer (4)
	OR $\tan A\hat{C}D = \frac{AD}{DC}$ $\tan A\hat{C}D = \frac{3}{\frac{9}{4}} = \frac{4}{3}$ $A\hat{C}D = 53{,}13°$ $\therefore A\hat{C}B = 106{,}26°$ [property of kite/*eienskappe van vlieër*]	✓ trig ratio in ΔACD or ΔBCD ✓ $\tan A\hat{C}D$ ✓ $A\hat{C}D$ ✓ answer (4)

	OR	
	AB = 6 units $AC = BC = \frac{15}{4}$ units [tangent from same point/ *raaklyne vanuit dieselfde punt*]	✓ AC = BC
	$(AB)^2 = (AC)^2 + (BC)^2 - 2(AC)(BC)\cos\hat{C}$ $(6)^2 = \left(\frac{15}{4}\right)^2 + \left(\frac{15}{4}\right)^2 - 2\left(\frac{15}{4}\right)\left(\frac{15}{4}\right)\cos\hat{C}$	✓ substitution into cosine-rule
	$\cos A\hat{C}B = -0{,}28$ $A\hat{C}B = 106{,}26°$	✓ simplification ✓ answer (4)
	OR	
	$\tan M\hat{A}B = m_{MA} = \frac{4}{3}$ $M\hat{A}B = 53{,}13°$ AMBC is a cyclic quad/ AMBC *is 'n kvh* $\therefore M\hat{C}B = 53{,}13°$ [∠s in the same seg/ *∠e in dies segm*] $\therefore A\hat{C}B = 106{,}26°$ [property of kite/ *eienskappe v vlieër*]	✓ $M\hat{A}B$ ✓ AMBC is a cyclic quad/*kvh* ✓ $M\hat{C}B$ ✓ answer (4)
		[21]

QUESTION/*VRAAG* 5

5.1.1	$r^2 = k^2 + 1^2$ [Pythagoras] $r = \sqrt{k^2+1}$ ✓  $\cos 40°$ $= \frac{k}{\sqrt{k^2+1}}$ ✓	✓ third side = $\sqrt{k^2+1}$ ✓ answer (2)
5.1.2	$\frac{2\sin 25°\cos 25°}{-2+4\sin^2 25°}$ $= \frac{\sin 50°}{-2(1-2\sin^2 25°)}$ ✓ $= \frac{\sin 50°}{-2\cos 50°}$ ✓ $= \left(\frac{k}{\sqrt{k^2+1}}\right) \div \left(\frac{-2}{\sqrt{k^2+1}}\right)$ ✓ OR $= -\frac{1}{2}\tan 50°$ $= -\frac{1}{2}k$ ✓	✓ $\sin 50°$ ✓ $-2(1-2\sin^2 25°)$ ✓ double angle ✓ subst **OR** quotient identity ✓ answer (5)
5.1.3	$\sin 10° = \sin(50° - 40°)$ ✓ $= \sin 50°\cos 40° - \cos 50°\sin 40°$ ✓ $= \left(\frac{k}{\sqrt{k^2+1}}\right)\left(\frac{k}{\sqrt{k^2+1}}\right) - \left(\frac{1}{\sqrt{k^2+1}}\right)\left(\frac{1}{\sqrt{k^2+1}}\right)$ ✓ $= \frac{k^2-1}{k^2+1}$ **OR** $\sin 10°$ $= \cos 80°$ ✓ $= \cos 2(40°)$ $= 2\cos^2 40° - 1$ ✓ $= 2\left(\frac{k}{\sqrt{k^2+1}}\right)^2 - 1$ ✓ $= \frac{2k^2}{k^2+1} - 1$ $= \frac{k^2-1}{k^2+1}$ **OR**	✓ $\sin 10° = \sin(50° - 40°)$ ✓ correct expansion ✓ first term ✓ second term (4) ✓ $\sin 10° = \cos 80°$ ✓ correct expansion ✓✓ substitution (4)

	$\sin 10^\circ = \sin(60^\circ - 50^\circ)$ ✓ $= \sin 60^\circ \cos 50^\circ - \cos 60^\circ \sin 50^\circ$ ✓ $= \left(\frac{\sqrt{3}}{2}\right)\left(\frac{1}{\sqrt{k^2+1}}\right) - \left(\frac{1}{2}\right)\left(\frac{k}{\sqrt{k^2+1}}\right)$ ✓ $= \frac{\sqrt{3}-k}{2\sqrt{k^2+1}}$ $\sin 10^\circ = \sin(40^\circ - 30^\circ)$	✓ $\sin 10^\circ = \sin(60^\circ - 50^\circ)$ ✓ correct expansion ✓ first term ✓ second term (4)
5.2.1	$\frac{\sin(540^\circ + x).\cos(90^\circ + x)}{\sin(-x)}$ ✓ $= \frac{(-\sin x)(-\sin x)}{(-\sin x)}$ ✓ $= -\sin x$ ✓	✓ $\sin(540^\circ + x) = -\sin x$ ✓ $\cos(90^\circ + x) = -\sin x$ ✓ $\sin(-x) = -\sin x$ ✓ answer (4)
5.2.2	$x \in (180^\circ; 360^\circ)$ ✓ 1: CV 1: Notation **OR** $180^\circ < x < 360^\circ$ ✓ CA	✓✓ $x \in (180^\circ; 360^\circ)$ (2) ✓✓ $180^\circ < x < 360^\circ$ (2)
		[17]

QUESTION/VRAAG 6

6.1	$\text{LHS} = \left[\tan(180° - x)\right](1 - \cos^2 x) + \cos^2 x$	
	$= (-\tan x)(\sin^2 x) + \cos^2 x$	✓ $\tan(180° - x) = -\tan x$
	$= \left(-\frac{\sin x}{\cos x}\right)(\sin^2 x) + \cos^2 x$	✓ $1 - \cos^2 x = \sin^2 x$ ✓ quotient identity
	$= -\frac{\sin^3 x}{\cos x} + \cos^2 x$	
	$= \frac{\sin^3 x - \cos^3 x}{-\cos x}$	✓ simplification to a single fraction
	$= \frac{(\sin x - \cos x)(\sin^2 x + \sin x.\cos x + \cos^2 x)}{-\cos x}$	✓ factors for a difference of cubes
	$= \frac{(\sin x - \cos x)(1 + \sin x.\cos x)}{-\cos x}$	✓ $\sin^2 x + \cos^2 x = 1$
	$= \text{RHS}$	(6)
	OR	
	$\text{RHS} = \frac{(\sin x - \cos x)(1 + \sin x.\cos x)}{-\cos x}$	
	$= \frac{(\sin x - \cos x)(\cos^2 x + \sin^2 x + \sin x.\cos x)}{-\cos x}$	✓ $1 = \sin^2 x + \cos^2 x$
	$= \frac{\sin x\cos^2 x + \sin^3 x + \sin^2 x\cos x - \cos^3 x - \sin^2 x\cos x - \sin x.\cos^2 x}{-\cos x}$	✓ expansion
	$= \frac{\sin^3 x - \cos^3 x}{-\cos x}$	✓ simplification
	$= \frac{\sin^3 x}{-\cos x} + \cos^2 x$	✓ split fraction
	$= \frac{-\sin x}{\cos x}(\sin^2 x) + \cos^2 x$	✓ quotient identity
	$= -\tan x(1 - \cos^2 x) + \cos^2 x$	✓ $\sin^2 x = 1 - \cos^2 x$
	$= \text{LHS}$	(6)

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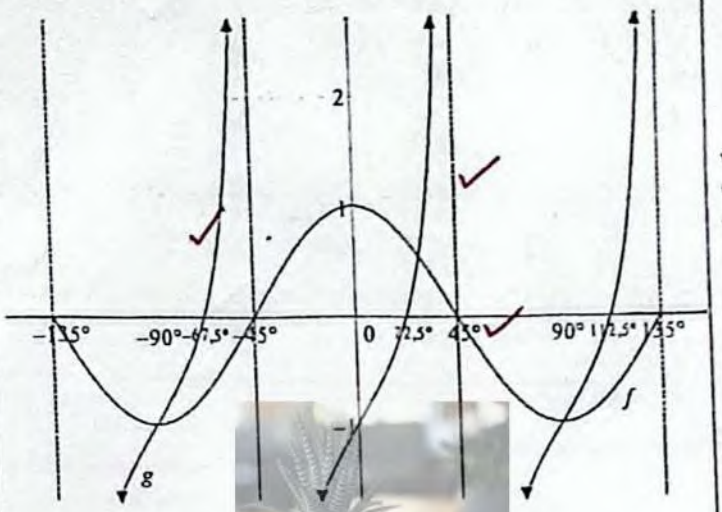
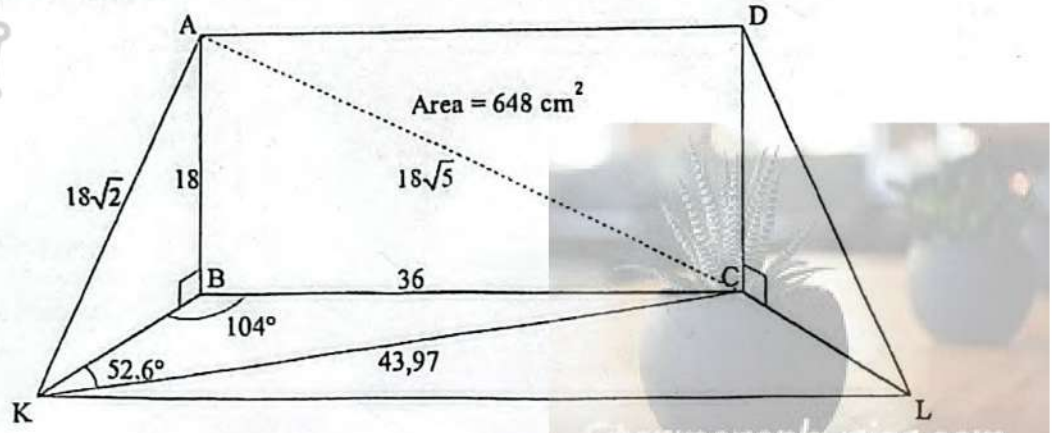
6.2	$\sin^3 x + \cos^3 x = \frac{1}{2}\sin 2x$	
	$\cos^3 x - \sin^3 x = \frac{1}{2}\sin 2x - \cos^3 x$ ✓	✓ $\cos^3 x - \sin^3 x = \frac{1}{2}\sin 2x - \cos^2 x$
	$\cos^3 x - \sin^3 x = \frac{1}{2}(2\sin x \cos x) - \cos^3 x$ ✓	✓ $\sin 2x = 2\sin x \cos x$
	$\cos^3 x - \sin^3 x = \sin x \cos x - \cos^3 x$	
	$2\cos^3 x - \sin x \cos x - \sin^3 x = 0$ ✓	✓ standard form
	$(2\cos x + \sin x)(\cos x - \sin x) = 0$ ✓	✓ factors
	$2\cos x = -\sin x$ or $\cos x = \sin x$ ✓	✓ both equations
	$\tan x = -2$ or $\tan x = 1$ ✓	
	ref $\angle = 63,43°$ or ref $\angle = 45°$	
	$x = 116,57° + k.180°$ or $x = 45° + k.180°; k \in Z$	✓ $x = 116,57°$ ✓ $116,57° + k.180°; k \in Z$
	OR	(7)
	$\sin^3 x + \cos^3 x = \frac{1}{2}\sin 2x$	
	$\cos^3 x - \sin^3 x = \frac{1}{2}\sin 2x - \cos^2 x$	✓ $\cos^3 x - \sin^3 x = \frac{1}{2}\sin 2x - \cos^2 x$
	$\cos^3 x - \sin^3 x = \frac{1}{2}(2\sin x \cos x) - \cos^2 x$	✓ $\sin 2x = 2\sin x \cos x$
	$\cos^3 x - \sin^3 x = \sin x \cos x - \cos^2 x$	
	$\cos^3 x - \sin^3 x - \sin x \cos x + \cos^2 x = 0$	
	$(\cos x - \sin x)(\cos x + \sin x) + \cos x(\cos x - \sin x) = 0$	✓ factors
	$(\cos x - \sin x)(\cos x + \sin x + \cos x) = 0$	✓ factors
	$\cos x = \sin x$ or $2\cos x = -\sin x$	✓ both equations
	$\tan x = 1$ $\quad$ $\tan x = -2$	
	ref $\angle = 45°$ $\quad$ ref $\angle = 63,43°$	
	$x = 45° + k.180°; k \in Z$ $\quad$ $x = 116,57° + k.180°$	✓ $x = 116,57°$ ✓ $116,57° + k.180°; k \in Z$
		(7)
		[13]

QUESTION/*VRAAG* 7

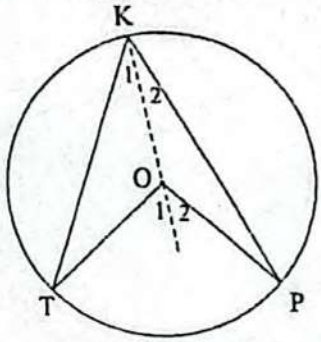
7.1	180° ✓	✓ answer (1)
7.2		✓ asymptotes ✓ shape ✓ intercepts with axes (3)
7.3	$f(x)=\cos 2x$ $h(x)=\cos 2(x+45°)$ $=\cos(2x+90°)$ $=-\sin 2x$ ✓	✓ answer (1)
7.4	$y\in[-1;1]$ ✓ Accuracy **OR** $-1\le y\le 1$	✓ $y\in[-1;1]$ (1) ✓ $-1\le y\le 1$ (1)
7.5	$\tan 2x-1=0$ $\tan 2x=1$ $2x=45°$ $x=22,5°$ ✓ ← Also check on the sketch, $(1-\tan 2x)(\cos 2x)\ge 0$ $-(\tan 2x-1)(\cos 2x)\ge 0$ $(\tan 2x-1)(\cos 2x)\le 0$ ✓ $x\in[0°;22,5°]\cup[112,5°;135°)$ ✓ **OR** $0°\le x\le 22,5°$ or $112,5°\le x<135°$	✓ $x=22,5°$ ✓ $(\tan 2x-1)(\cos 2x)\le 0$ ✓ first interval ✓ second interval (4)
	[22.5 ; 45) (45; 112.5] AD: 2	[10]

QUESTION/*VRAAG* 8



8.1	Area of ABCD = BC × AB $648 = 2AB \times AB$ $AB^2 = 324$ $AB = 18$ cm	✓ BC = 2AB ✓ substitution into area of rectangle (2)
8.2	$AC^2 = AB^2 + BC^2$ [Pythagoras] $= 18^2 + 36^2$ $AC = \sqrt{1620} = 18\sqrt{5} = 40,25$ cm	✓ $AC^2 = 18^2 + 36^2$ ✓ answer (2)
8.3	$\frac{KC}{\sin K\hat{B}C} = \frac{BC}{\sin B\hat{K}C}$ $\frac{KC}{\sin 104°} = \frac{36}{\sin 52,6°}$ $KC = \frac{36\sin 104°}{\sin 52,6°}$ $KC = 43,97$ cm	✓ substitution into sine rule ✓ answer (2)
8.4	$AK^2 = AB^2 + BK^2$ [Pythagoras] $= 18^2 + 18^2$ $AK = \sqrt{648} = 18\sqrt{2}$ cm $= 25,46$ cm $KC^2 = AK^2 + AC^2 - 2AK.AC\cos K\hat{A}C$ $(43,97)^2 = (18\sqrt{2})^2 + (18\sqrt{5})^2 - 2(18\sqrt{2})(18\sqrt{5})(\cos K\hat{A}C)$ $\cos K\hat{A}C = 0,16...$ $K\hat{A}C = 80,60°$	✓ length of AK ✓ substitution into cosine rule ✓ simplification ✓ answer (4)
		[10]

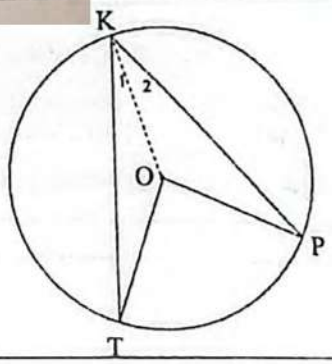
QUESTION/VRAAG 9



No constr: BD.

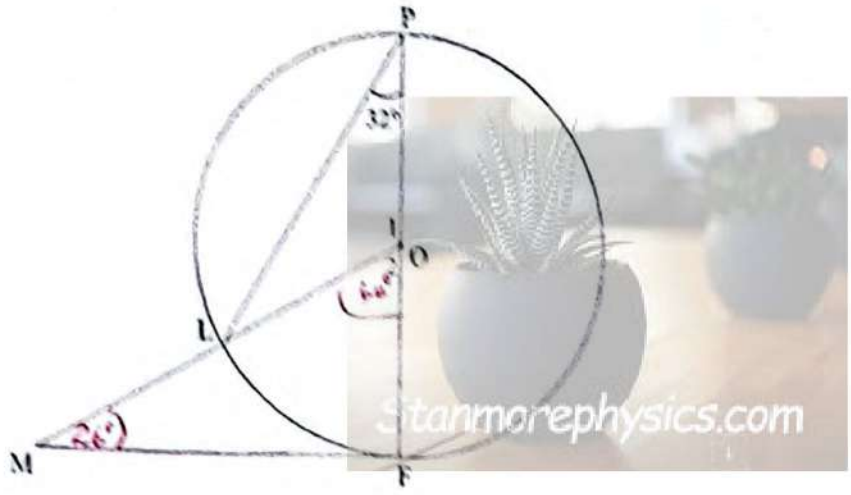
9.1	Construction: Draw KO produced	✓ construction
	$\hat{O}_1 = \hat{K}_1 + \hat{T}$ [ext ∠ of Δ/*buite ∠ van Δ*]	
	But $\hat{K}_1 = \hat{T}$ [∠s opp equal sides/*∠e teenoor gelyke sye*]	✓ S / R
	$\therefore \hat{O}_1 = 2\hat{K}_1$ If no labels then mark upto $\hat{O}_1 = 2\hat{K}$ ∴ 3/5	✓ S
	$\hat{O}_2 = \hat{K}_2 + P$ [ext ∠ of Δ/*buite ∠ van Δ*]	
	But $\hat{K}_2 = P$ [∠s opp equal sides/*∠e teenoor gelyke sye*]	
	$\therefore \hat{O}_2 = 2\hat{K}_2$	✓ S
	$\therefore \hat{O}_1 + \hat{O}_2 = 2\hat{K}_1 + 2\hat{K}_2$	✓ S
	$= 2(\hat{K}_1 + \hat{K}_2)$	
	$\therefore T\hat{O}P = 2\,T\hat{K}P$	(5)

OR



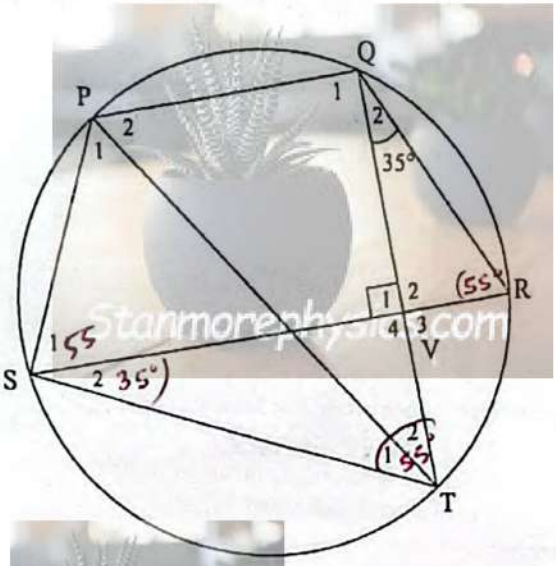
9.1	Construction: Draw KO	✓ construction
	$\hat{T} = \hat{K}_1$ [∠ s opp. equal sides/*∠e teenoor gelyke sye*]	✓ S / R
	$\therefore K\hat{O}T = 180° - 2\hat{K}_1$ [sum of ∠ s of Δ /*binne ∠e van Δ*]	✓ S
	$\hat{P} = \hat{K}_2$ [∠ s opp. equal sides/*∠e teenoor gelyke sye*]	
	$\therefore K\hat{O}P = 180° - 2\hat{K}_2$ [sum of ∠ s of Δ / *binne ∠e van Δ*]	✓ S
	$T\hat{O}P = 360° - (K\hat{O}T + K\hat{O}P)$ [∠ s around a point/*∠e om 'n punt*]	✓ S
	$= 360° - (180° - 2\hat{K}_1 + 180° - 2\hat{K}_2)$	
	$= 2\hat{K}_1 + 2\hat{K}_2$ If both options are combined 2/5	
	$= 2(\hat{K}_1 + \hat{K}_2)$	
	$\therefore T\hat{O}P = 2\,T\hat{K}P$	(5)

9.2



9.2.1	$\hat{O}_2 = 64°$ ✓	[∠ at centre = 2 × ∠ at circumference/ ✓ *Middpts ∠ = 2 × Omtreks ∠*]	✓ S ✓ R (2)
	OR		
	$PLO = \hat{P} = 32°$	[∠s opp equal radii/ *∠e teenoor gelyke radiusse*]	✓ S / R
	$\hat{O}_2 = 64°$	[ext ∠ of Δ / *buite ∠ van Δ*]	✓ S (2)
9.2.2	$P\hat{F}M = 90°$ ✓	[tan ⊥ diameter/*raaklyn ⊥ middellyn*] ✓	✓ S ✓ R
	$\hat{M} = 26°$ ✓	[sum of ∠s of Δ/*binne ∠e van Δ*]	✓ S (3)
			[10]

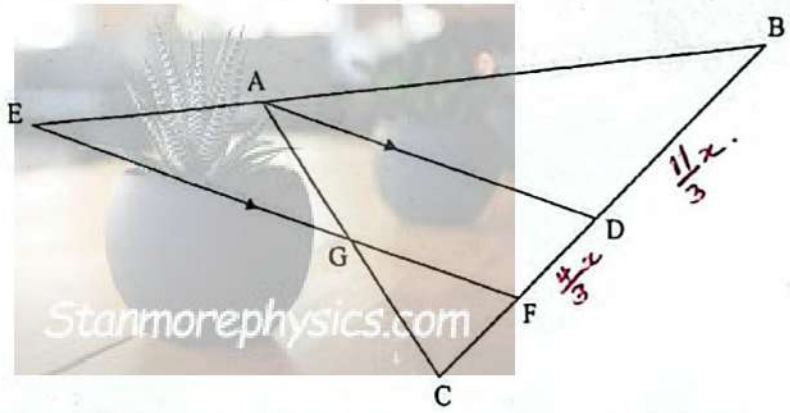
QUESTION/VRAAG 10



10.1	$\hat{R}=55°$ ✓ [sum of ∠s in Δ/*binne ∠e van Δ*] $\therefore Q\hat{T}S=55°$ ✓ [∠s in the same seg/*∠e in dieselfde segment*] **OR** $\hat{S}_2=35°$ [∠s in the same seg/*∠e in dieselfde segment*] $\therefore Q\hat{T}S=55°$ [sum of ∠s in Δ/*binne ∠e van Δ*]	✓S ✓S ✓R (3) ✓S ✓R ✓S (3)
10.2	$S\hat{P}Q=125°$ ✓ [opp ∠s of cyclic quad/teenoorst. *∠e van kvh*] $\hat{S}_1=\hat{R}=55°$ [given/*gegee*] $S\hat{P}Q+\hat{S}_1=180°$ $\therefore PQ \parallel SR$ [co-int ∠s supp/*ko-binne ∠e suppl*] ✓ **OR** $\hat{S}_1=\hat{R}=55°$ [given/*gegee*] $P\hat{Q}R=125°$ ✓ [opp ∠s of cyclic quad/teenoorst. *∠e van kvh*] $\therefore \hat{Q}_1=125°-35°=90°$ $\therefore \hat{Q}_1+\hat{V}_1=180°$ $\therefore PQ \parallel SR$ [co-int ∠s supp/*ko-binne ∠e suppl*] ✓	✓S ✓R ✓R (3) ✓S ✓R ✓R (3)

10.3	$\hat{Q}_1 = 90°$ ✓	[co-int ∠s; PQ‖ SR/ *ko-binne ∠e; PQ ||SR*]	✓ S
	∴ PT is a diameter	[converse ∠ in semi-circle/ chord subtends 90°∠ *omgekeerde ∠ in halwe sirkel / koord onderspan* 90° ∠]	✓ R (2)
	OR		
	$\hat{S}_2 = 35°$ ✓	[ext ∠ of ΔSVT or sum of ∠s in Δ *buite ∠ v Δ of binne ∠e van Δ*]	✓ S
	$P\hat{S}T = 90°$		
	∴ PT is a diameter	[converse ∠ in semi-circle/ chord subtends 90°∠ *omgekeerde ∠ in halwe sirkel / koord onderspan* 90° ∠]	✓ R (2)
			[8]

QUESTION/*VRAAG* 11

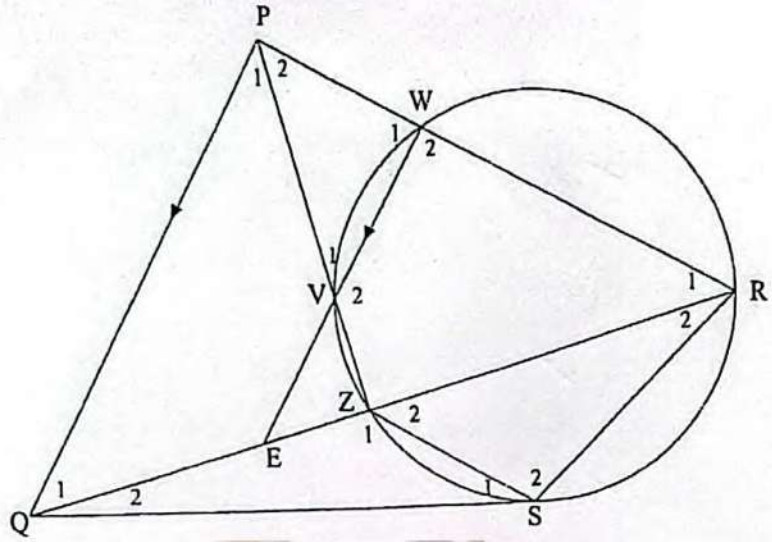


11.1.1	$\frac{FD}{CF} = \frac{GA}{CG}$ ✓[prop theorem; AD ‖ EF/line ‖ one side of Δ/ *eweredigheidst.; AD ‖ EF / lyn ‖ een sy v Δ*] $\frac{FD}{CF} = \frac{2}{3}$ ✓	✓ S ✓ answer (2)
11.1.2	$FD = \frac{2}{3}CF$ $FD = \frac{2}{3}(2x) = \frac{4}{3}x$ ✓ $\frac{BA}{EA} = \frac{BD}{FD}$ ✓[prop theorem; AD ‖ EF/line ‖ one side of Δ/ *eweredigheidst.; AD ‖ EF / lyn ‖ een sy v Δ*] $\frac{BA}{EA} = \frac{5x - \frac{4}{3}x}{\frac{4}{3}x}$ ✓ $= \frac{11}{3} \times \frac{3}{4}$ $= \frac{11}{4}$ ✓	✓ $\frac{4}{3}x$ ✓ S ✓ substitution ✓ answer (4)

11.1.3	$\frac{\text{Area of } \Delta GCF}{\text{Area of } GFDA} = \frac{\text{Area } \Delta GCF}{\text{Area } \Delta CDA - \text{Area } \Delta GCF}$ ✓ $= \frac{\frac{1}{2}GC.CF\sin\hat{C}}{\frac{1}{2}AC.CD\sin\hat{C} - \frac{1}{2}GC.CF\sin\hat{C}}$ ✓ ✓ $= \frac{\frac{1}{2}(3k)(3p)(\sin\hat{C})}{\frac{1}{2}(5k)(5p)(\sin\hat{C}) - \frac{1}{2}(3k)(3p)(\sin\hat{C})}$ $= \frac{\frac{1}{2}(9kp)(\sin\hat{C})}{\frac{1}{2}\sin\hat{C}(25kp - 9kp)}$ $= \frac{9}{16}$ ✓	✓ $GFDA = \Delta CDA - \Delta CGF$ ✓ $\frac{1}{2}(GC)(FC)\sin\hat{C}$ ✓ $\frac{1}{2}AC.CD\sin\hat{C} - \frac{1}{2}GC.CF\sin\hat{C}$ ✓ answer (4)

Assuming AGFD is a trap, and using AG or DF as ⊥ height, then only 1/4

11.2



11.2.1	$\frac{QE}{QR}=\frac{PW}{PR}$ ✓ [prop theorem; PQ ‖ WE/line ‖ one side of Δ / *eweredigheidst.; PQ ‖ WE / lyn ‖ een sy v Δ*] ✓ $PR=\frac{PW.QR}{QE}$	✓ S ✓ R (2)
11.2.2	$\frac{PQ}{RQ}=\frac{QZ}{QP}$ ✓ [ΔPQZ ||| ΔRQP] $\therefore PQ^2 = RQ.QZ$	✓ $\frac{PQ}{RQ}=\frac{QZ}{QP}$ (1)
11.2.3	In ΔQSZ and ΔQRS $\hat{Q}_2=\hat{Q}_2$ ✓ [common ∠ / *gemeenskaplike∠*] $\hat{S}_1=\hat{R}_2$ ✓ [tan chord theorem/*raaklyn koord stelling*] $\hat{Z}_1=Q\hat{S}R$ [3rd ∠ of Δ] $\therefore$ ΔQSZ ||| ΔQRS [∠∠∠]	✓ S ✓ S/R ✓ S OR R (3)
11.2.4	$\frac{QS}{QR}=\frac{QZ}{QS}$ ✓ [ΔQSZ|||ΔQRS] $\therefore QS^2 = QZ.QR$ ✓ But $PQ^2 = RQ.QZ$ ✓ [proved in 11.2.2] $\therefore PQ = QS$	✓ S / R ✓ S ✓ S (3)

Penalize for not indic ‖ lines.
Accept ‖ lines without Prop theorem.
must be shown in 11.2.2.

11.2.5	$\frac{PQ}{RQ}=\frac{PZ}{PR}$ [$\Delta PQZ \| \| \Delta RQP$] $PR=\frac{QR.PZ}{PQ}$ ✓ (1) $PR=\frac{PW.QR}{QE}$ [proved in 11.2.1] (2) $\therefore \frac{PW.QR}{QE}=\frac{QR.PZ}{PQ}$ ✓ (1)=(2) $PW=\frac{QE.PZ}{PQ}$ ✓ ← This statem must not just be given without calculation. But $PQ^2 = RQ.QZ$ [proved in 11.2.2] $\therefore PQ=\sqrt{RQ.QZ}$ ✓ $\therefore PW=\frac{QE.PZ}{\sqrt{QR.QZ}}$	✓ $PR=\frac{QR.PZ}{PQ}$ ✓ S ✓ $PW=\frac{QE.PZ}{PQ}$ ✓ $PQ=\sqrt{RQ.QZ}$ (4)
		[23]

TOTAL/*TOTAAL*: 150

2025 -11- 12
APPROVED MARKING GUIDELINE
PUBLIC EXAMINATION