education

Department:
Education
North West Provincial Government
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

MATHEMATICS P2

SEPTEMBER 2025

MARKS: 150

TIME: 3 hours

This question paper consists 12 pages, 1 information sheet and an answer book of 22 pages.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This 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 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

A survey was done under 100 members of a gymnasium about the cost of their annual membership contract.
Results showed an average annual payment of R3 240.

AMOUNT (R)	FREQUENCY
$0 \leq x < 1000$	8
$1\,000 \leq x < 2\,000$	12
$2\,000 \leq x < 3\,000$	P
$3\,000 \leq x < 4\,000$	30
$4\,000 \leq x < 5\,000$	Q
$5\,000 \leq x < 6\,000$	12

1.1 How many members payed less than R2 000 for their annual contract? (1)

1.2 Proof by calculation that P = 20 and Q = 18. (5)

1.3 Hence, complete the cumulative frequency table in the ANSWER BOOK. (2)

1.4 Use the cumulative frequency table to draw an ogive to illustrate the information above. (3)

1.5 Use the ogive to determine how many members spent more than R4 200 annually on their contracts. (1)

[12]

QUESTION 2

Eight couples entered a dance competition. Two judges gave marks for their performances. The marks (out of 20) are shown in the table below.

COUPLE	1	2	3	4	5	6	7	8
JUDGE 1	18	4	6	8	5	12	10	14
JUDGE 2	15	6	3	5	5	14	8	15

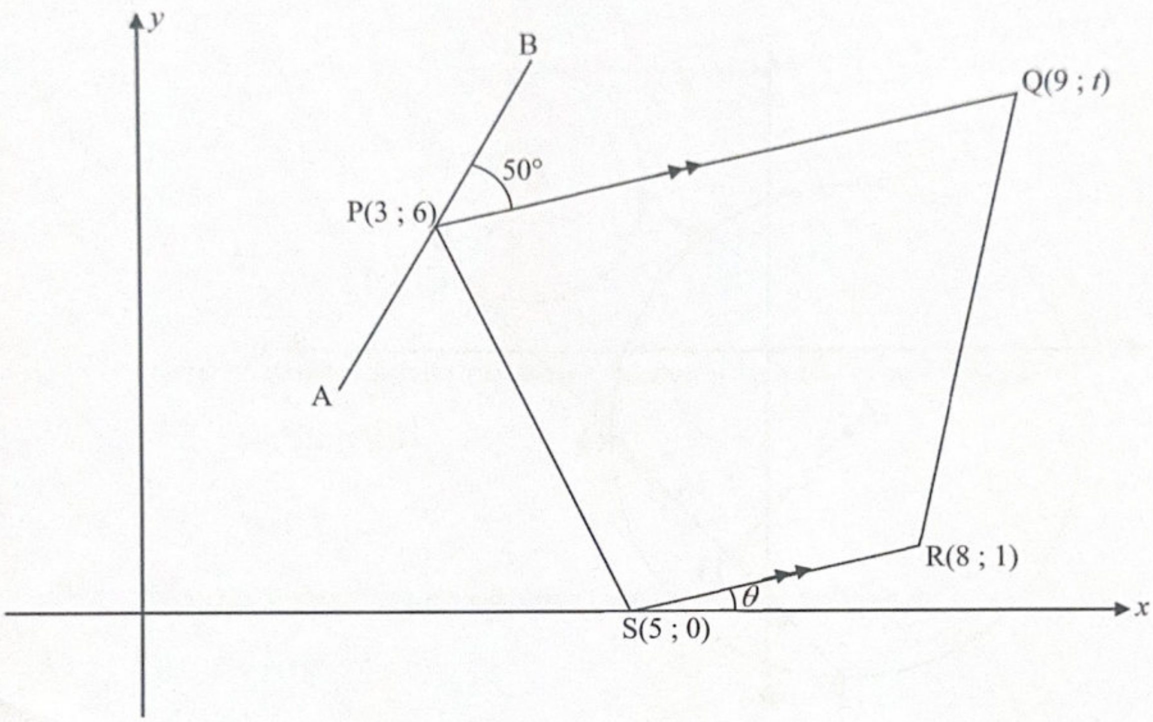
2.1 Determine the equation of the least squares regression line of the marks given by the two judges. (3)

2.2 A ninth couple had a late entry in the competition and received a mark of 15 by JUDGE 1. Calculate to the nearest integer, the mark they possibly would have received from JUDGE 2. (2)

2.3 Are the judges consistent when allocating marks?
Motivate your answer with appropriate calculations. (3)
[8]

QUESTION 3

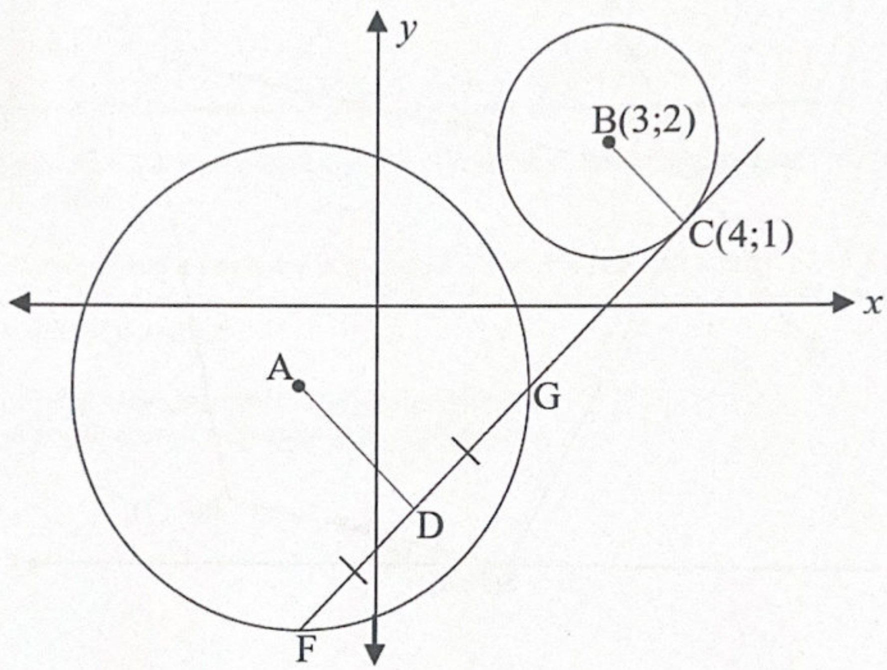
In the diagram below PQRS is a quadrilateral with vertices P(3 ; 6), Q(9 ; t), R(8 ; 1) and S(5 ; 0). PQ || SR.
AB is a straight line that touches the quadrilateral at P. $Q\hat{P}B = 50°$



3.1	Calculate the gradient of SR.	(2)
3.2	Determine the equation of PQ in the form $y = mx + c$.	(3)
3.3	Calculate the value of t.	(2)
3.4	Calculate the length of PQ if $t = 8$.	(2)
3.5	Proof that PS is perpendicular to SR.	(3)
3.6	If PQ = PS, calculate the area of PQRS.	(6)
3.7	Calculate the value of θ, the angle of inclination of SR.	(2)
3.8	Calculate the equation of AB. Show ALL working.	(6)
		[26]

QUESTION 4

In the diagram below the circle with centre A has the equation $(x+1)^2+(y+1)^2=9$.
FG is a chord of circle A. AD bisects chord FG.
FGC is a tangent to the circle with centre $B(3\,;2)$ at point $C(4\,;1)$.



4.1 Write down the coordinates of A. (1)

4.2 Determine the equation of tangent FC, in the form $y = mx + c$. (4)

4.3 Given: $AD = \dfrac{\sqrt{10}}{2}$ units. Calculate the length of FG. (4)

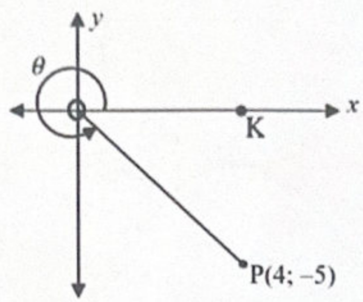
4.4 Determine the length of AB. (2)

4.5 Another circle with centre B, touches the circle with centre A at K.
Determine the equation of the new circle. (3)

[14]

QUESTION 5

5.1 In the diagram below, line OP is given with $P(4;-5)$. $K\hat{O}P = \theta$



Calculate, **without using a calculator**, the numerical value of the following:

5.1.1 $\sin^2(180° + \theta)$ (4)

5.1.2 $\tan(-\theta)$ (2)

5.2 Calculate, **without using a calculator**, the value of the following:

5.2.1 $\cos 15°$ (6)

5.2.2 $\dfrac{\cos(90° + x).\cos(180° - x)}{\cos^2(180° + x).\tan(180° - x)}$ (5)

5.3 Given: $\dfrac{\sin 2\theta + 2\cos\theta - 2\cos^3\theta}{1 + \sin\theta} = \sin 2\theta$

5.3.1 Proof the identity. (5)

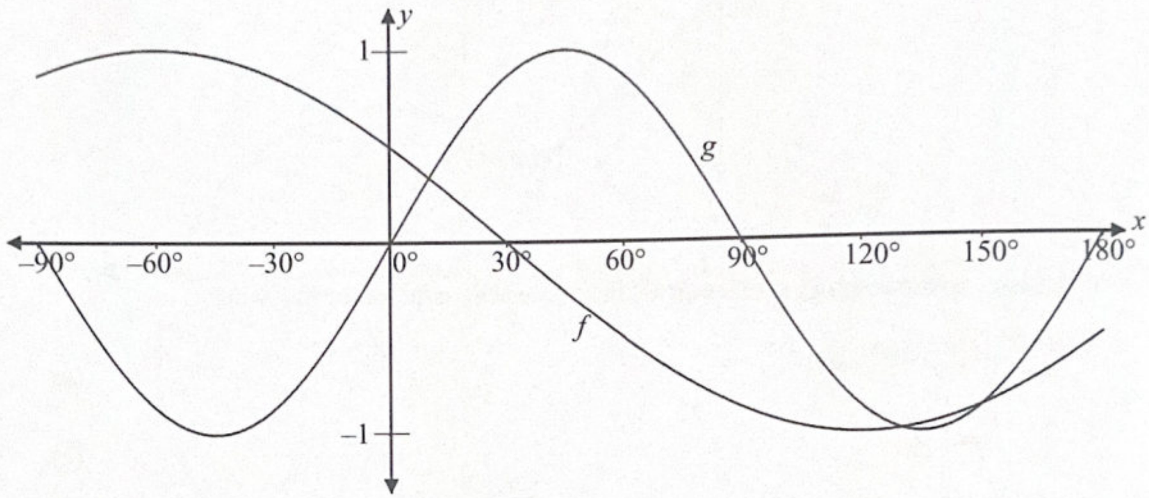
5.3.2 For which values of θ in the interval $[-360°; 360°]$ is the identity in QUESTION 5.3.1 undefined? (2)

5.4 Calculate the maximum value of $\dfrac{4}{2 + \cos x}$ (2)

[26]

QUESTION 6

In the diagram below, the graphs of $f(x)=\cos(x+60°)$ and $g(x)=\sin 2x$ are drawn for the interval $x\in[-90°;180°]$.



6.1 Calculate the values of x, in the interval $x\in[-90°\,;180°]$ for which $f(x) = g(x)$. (7)

6.2 Write down the period of $g(x)$. (1)

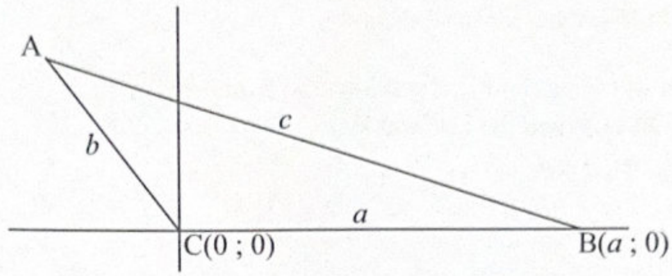
6.3 Use your answer in question 6.1 to determine the value(s) of x where $g(x)\geq f(x)$. (2)

6.4 Describe the transformation from h to p if $h(x)=\sin x$ and $p(x)=\sin(x-30°)$. (3)

[13]

QUESTION 7

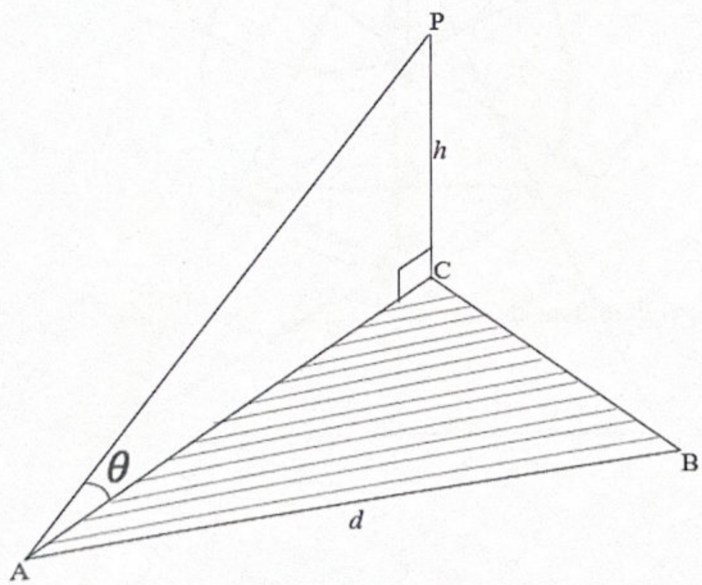
7.1 In the diagram below, ΔABC is $90° \leq C \leq 180°$.



Proof: $c^2 = a^2 + b^2 - 2ab\cos C$. (4)

7.2 In the diagram below, A, B and C are three points in the same horizontal plane.

- P is the image of a balloon vertically above C
- The angle of elevation to P from A is θ
- $A\hat{B}C = 90° - \alpha$
- $BC = \frac{1}{2}AB$
- $AB = d$ units



7.2.1 Prove that $h = \frac{d.\tan\theta.\sqrt{5-4\sin\alpha}}{2}$, where h is the height of the balloon above the ground. (4)

7.2.2 Determine the value of h if $d = 300\,m$, $\alpha = 32°$ and $\theta = 63°$. (3)

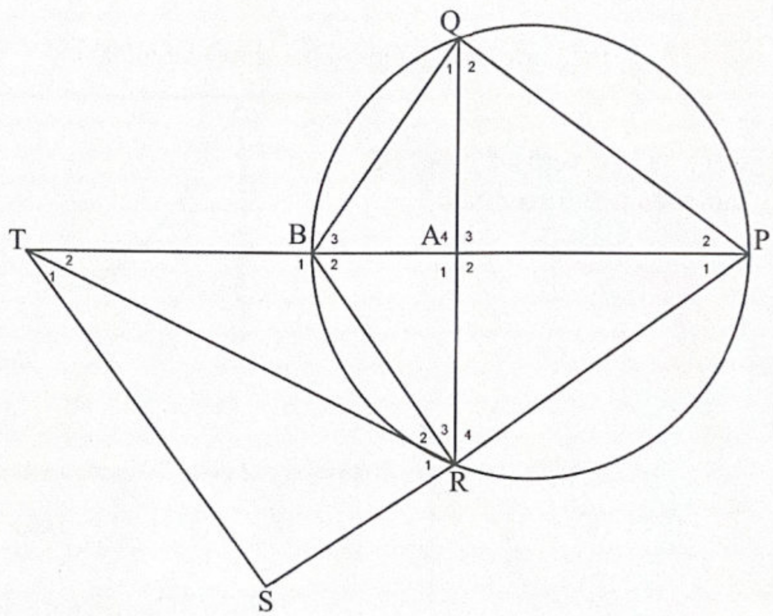
[11]

Provide reasons for your statements in QUESTION 8, 9 and 10.

QUESTION 8

In the diagram below PQBR is a cyclic quadrilateral.

- BP is a diameter of the circle. PR is produced to S, and PB to T
- PBT intersects QR at A and the circle at B
- RT bisects $Q\hat{R}S$, $TS \perp SP$
- $PQ = PR$



8.1 If $\hat{Q}_2 = 55°$, calculate with reasons the size of:

8.1.1 $\hat{R}_4$ (2)

8.1.2 $\hat{B}_3$ (2)

8.1.3 $B\hat{R}P$ (2)

8.1.4 $\hat{A}_1$ (3)

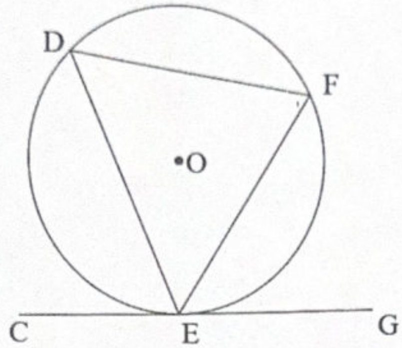
8.2 Give a reason why $AQ = AR$. (1)

8.3 Prove that $AT = TS$. (4)

[14]

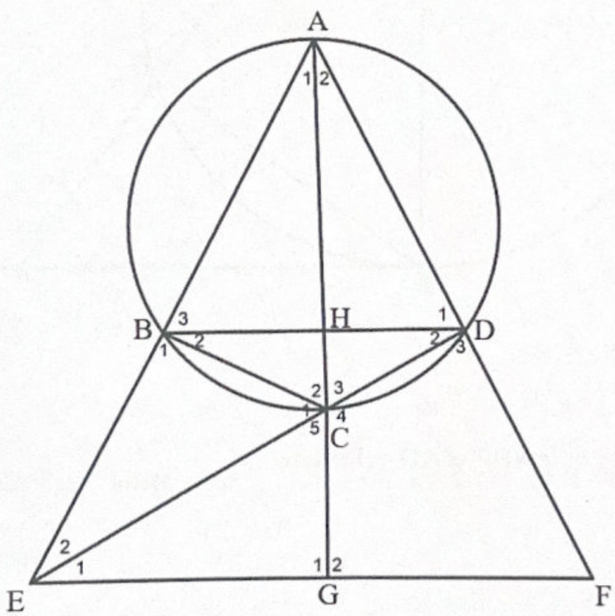
QUESTION 9

In the diagram O is the centre of the circle, with CEG a tangent to the circle.



9.1 Prove the theorem that states that $C\hat{E}D = \hat{F}$. (5)

9.2 In the diagram below, ABCD is a cyclic quadrilateral. EF || BD.
ACG and DCE are straight lines.



Prove that:

9.2.1 $\hat{E}_1 = \hat{A}_1$ (3)

9.2.2 EF is a tangent to the circle EAC (1)

9.2.3 $\Delta ABC \; ||| \; \Delta EDF$ (4)

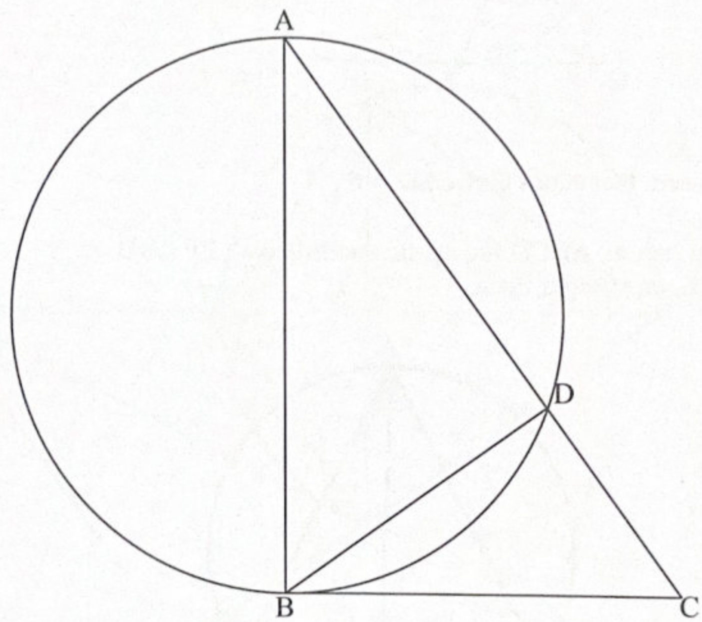
9.2.4 $\dfrac{BE.AH}{GH} = \dfrac{ED.BC}{DC}$ (6)

[19]

QUESTION 10

In the diagram below, AB is a diameter of the circle. CB is a tangent to the circle at B. AC intersect the circle at D.

- DC = x
- DC = $\frac{1}{2}$AD



10.1 Prove that $\frac{BD}{DC} = \sqrt{2}$ (4)

10.2 Calculate the perimeter of $\triangle ABC$ if AD = 10 mm. (3)
[7]

TOTAL: 150

INFORMATION SHEET

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

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

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

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

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

$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$ $\quad x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

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

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

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

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

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

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

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

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

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

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

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

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

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