education

Department of
Education
FREE STATE PROVINCE

PREPARATORY EXAMINATION

GRADE 12

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MATHEMATICS P2

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TIME: 3 HOURS

SEPTEMBER 2025

MATHEMATICS P2

N2612B

MARKS: 150

X05

N4

This question paper consists of 13 pages, 1 information sheet and an answer book of 24 pages.

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INSTRUCTIONS AND INFORMATION

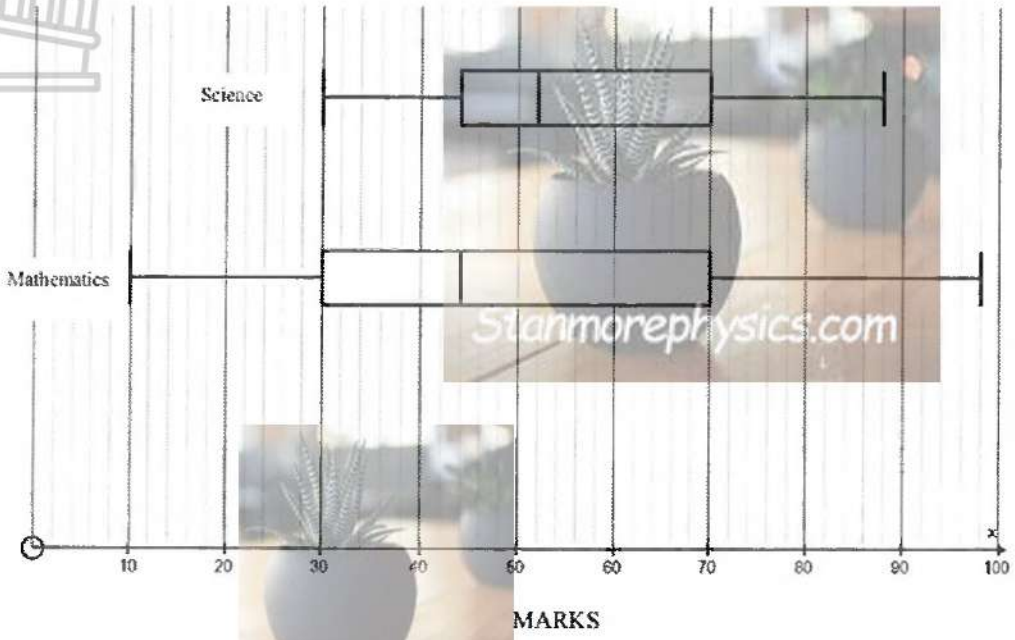
Read the following instructions carefully before answering the questions.

1. This 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 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. Number the answers correctly according to the numbering system used in this question paper.
9. An information sheet with formulae is included at the end of the question paper.
10. Write neatly and legibly.

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QUESTION 1

The box and whisker diagrams below show the distribution of test scores obtained by a sample of students in Mathematics and Science.



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Use the diagram to determine the following:

1.1 The range for Mathematics. (2)

1.2 The median for Science. (1)

1.3 The interquartile range for Science. (2)

1.4 Which examination was easier for the students? Motivate your answer. (2)

1.5 Which examination has a weaker spread of scores? Justify by giving TWO reasons. (2)

1.6 If a learner from the Science sample is selected randomly, find the probability that the learner achieved a mark greater than 70%. (1)
[10]

QUESTION 2

Refer to the statements below and answer the questions that follow:

- A least squares regression line (a line of best fit) has an equation of $y = 49 - 3x$
- There is one outlier that has been identified as (9 ; 4)
- The correlation coefficient is very strong

2.1 If the outlier was removed, would the correlation coefficient be stronger? (Explain your answer.) (1)

2.2 Is the correlation coefficient closer to one or negative one? (Explain your answer.) (2)

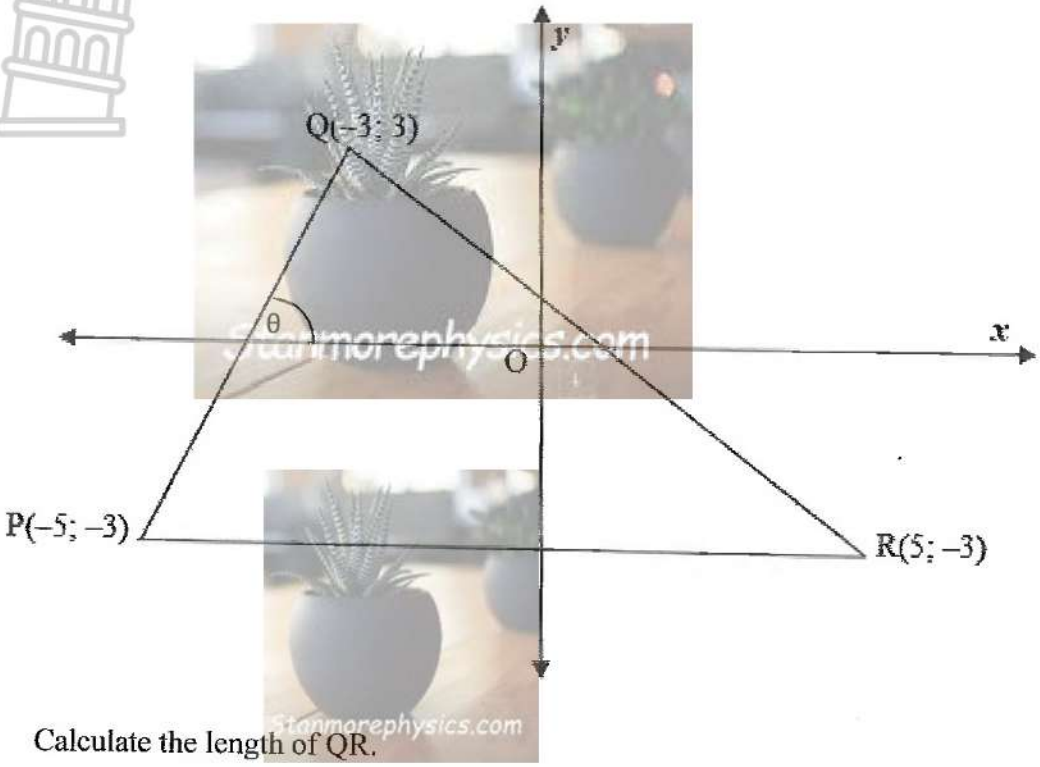
2.3 If a line of best fit is used, would it be perfectly accurate? (Explain your answer.) (2)

2.4 An individual predicts that if x has a value of 30, y will have a value of –41. However, his friend explains that he is extrapolating and that his result is inaccurate. Explain what his friend is referring to. (2)
[7]

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QUESTION 3

In the diagram below, PQR is a triangle with vertices P(–5; –3), Q(–3; 3) and R(5; –3)



3.1 Calculate the length of QR. (2)

3.2 Determine M, the midpoint of QR. (2)

3.3 Determine the equation of the line passing through P and M. (4)

3.4 Determine the equation of a circle that has QR as a diameter. (3)

3.5 Does point P lie inside or outside the circle in QUESTION 3.4?
Motivate your answer with relevant calculations. (3)

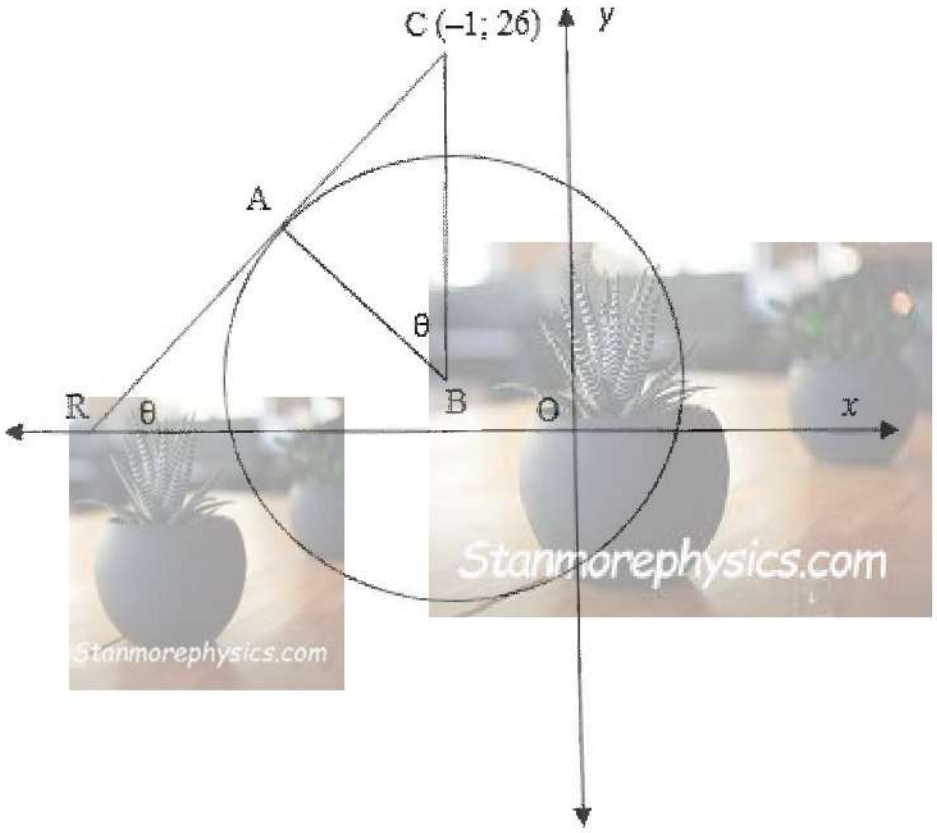
3.6 Determine the coordinates of S, if PQRS is a parallelogram, with S in the first quadrant. (2)

3.7 Calculate the size of $Q\widehat{P}R$. (4)
[20]

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QUESTION 4

In the diagram B(–1; 1) is the centre of the circle. CA is a tangent at A.
C is the point (–1; 26), $C\hat{B}A = A\hat{R}O = \theta$ and CA = 20 units.



Calculate the following:

4.1 The length of the radius of the circle. (4)

4.2 The equation of the circle. (2)

4.3 The equation of the tangent CR. (3)

4.4 The equation of the radius AB. (4)

4.5 The coordinates of A. (4)
[17]

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QUESTION 5

5.1 Solve:

5.1.1 If $\tan\theta = \frac{8}{6}$ and $0° < \theta < 90°$ show that

$10\sin(\theta + x) = 6\sin x + 8\cos x$ (4)

5.1.2 Hence, solve the following equation:

$6\sin x + 8\cos x = 9$ for $x \in [0°; 360°]$ (6)

5.2 Simplify:

$$\frac{\cos(90° + x).\cos(x - 180°).\tan(360° + x)}{\cos 240°.\tan 225°}$$ (7)

5.3 Prove the identity:

$$\frac{1 + \cos 2A}{\cos 2A} = \frac{\tan 2A}{\tan A}$$ (7)

5.4 If $\sin 32° = t$ determine $\sin 16°$ in terms of t. (3)

5.5 Given: $\cos(x + y) - \cos(x - y) = -2\sin x \sin y$

5.5.1 Prove the above identity (3)

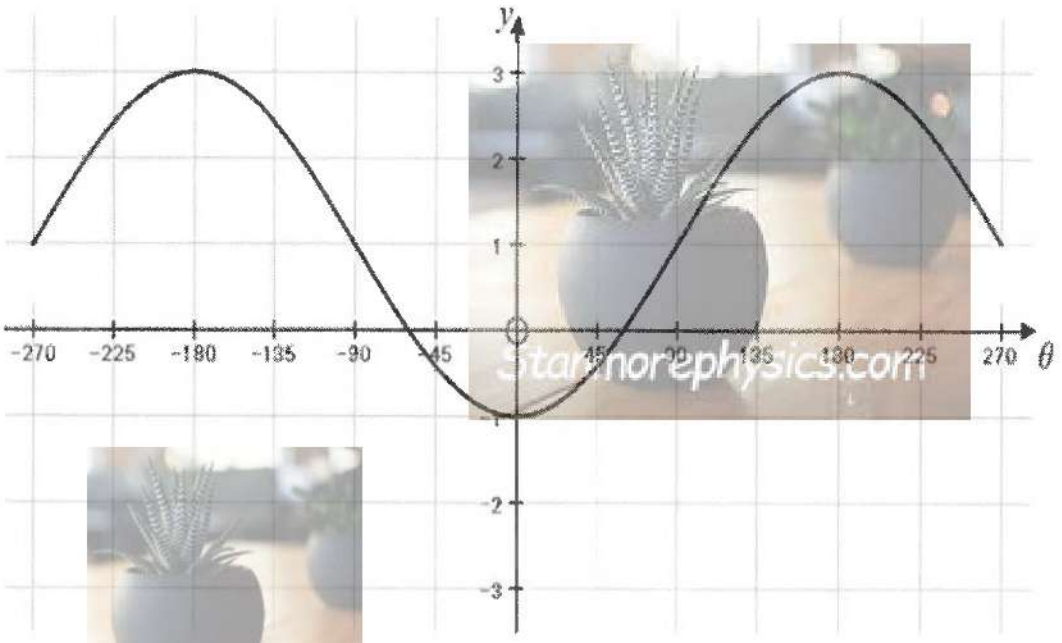
5.5.2 Hence deduce that $\cos A - \cos B = -2\sin\frac{A+B}{2}\sin\frac{A-B}{2}$ (2)

[32]

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QUESTION 6

In the diagram below, the graph of $f(\theta) = p\cos\theta + q$ is sketched for $-270° \leq \theta \leq 270°$



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6.1 Write down the amplitude of f. (1)

6.2 Write down the range of f. (1)

6.3 Write down the values of p and q. (2)

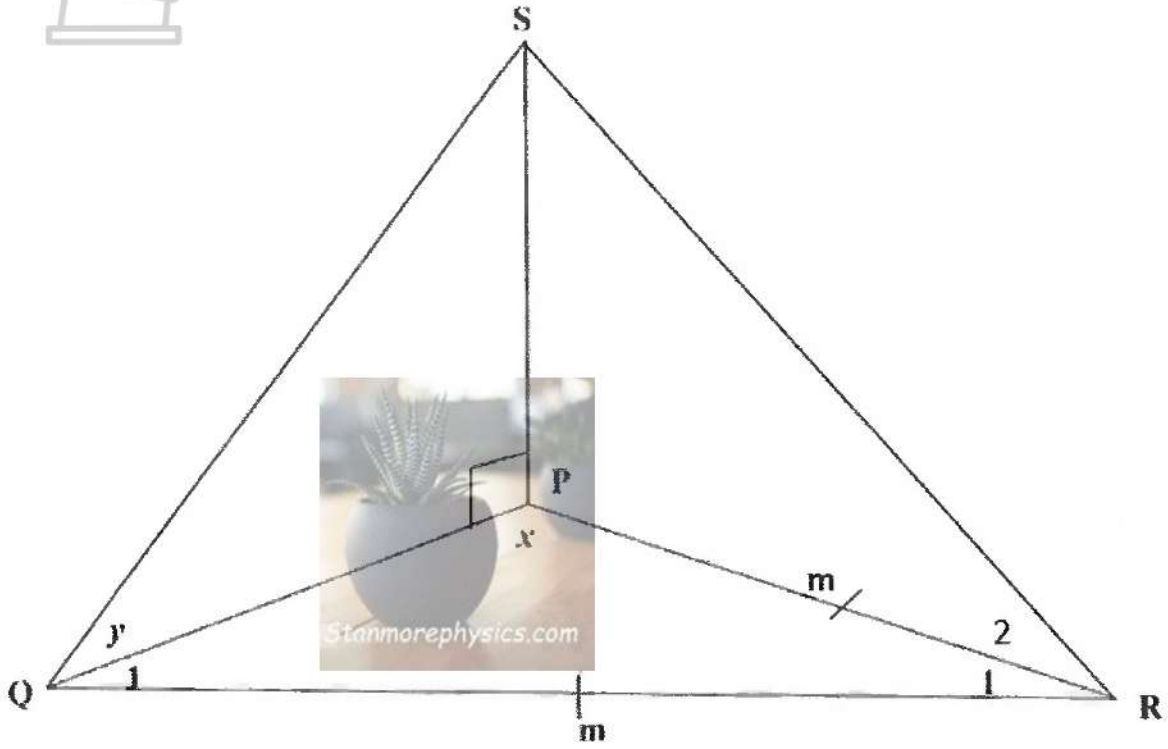
6.4 On the same set of axes, sketch the graph of $g(\theta) = -2\tan\theta$ for $\theta \in [-270°; 270°]$. (3)

6.5 Indicate on the graph using thickened lines the intervals on the horizontal θ axis, where $p\cos\theta + q \geq -2\tan\theta$ for $\theta \in [-270°; 270°]$. (3)

[10]

QUESTION 7

In the diagram, P, Q and R are three points on the same horizontal plane.
PR = QR = m, $\hat{QPR} = x$. SP is perpendicular to PQ. The angle of elevation of S from Q is y.



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7.1 Express the area ΔPQR in terms of x and m. Leave your answer in simplified form. (5)

7.2 Show that PQ = $2m\cos x$ (4)

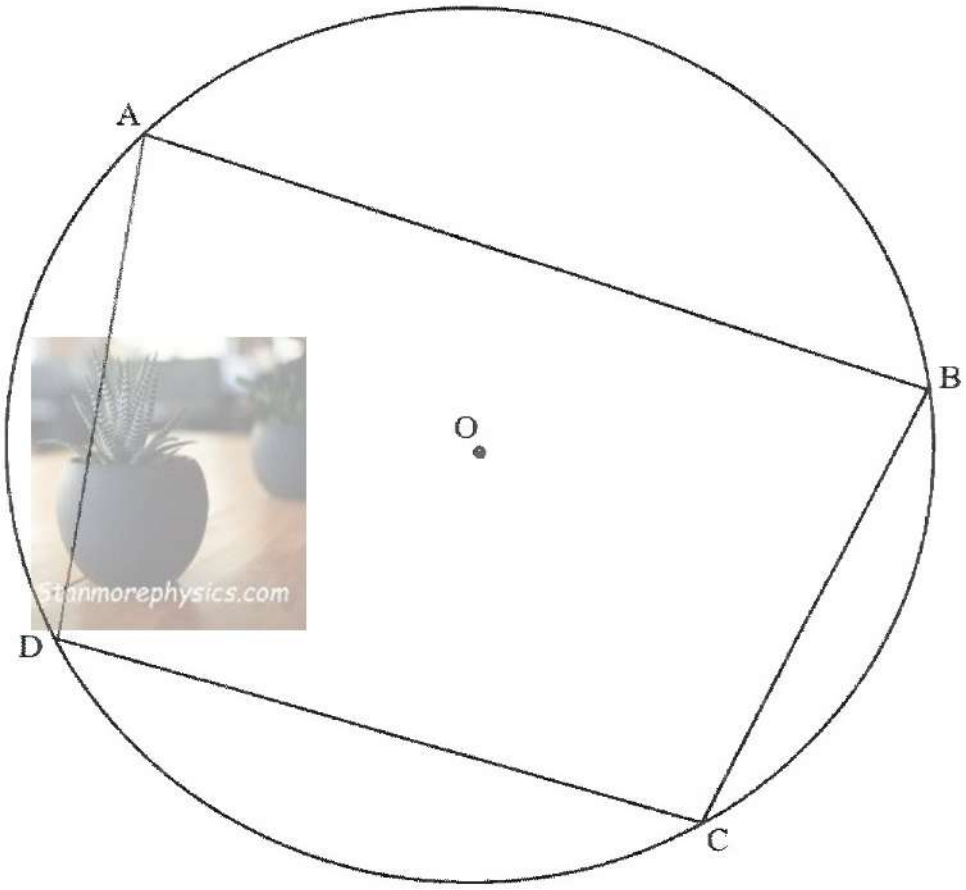
7.3 Hence, prove that SP = $2m\cos x \tan y$ (2)
[11]

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

QUESTION 8

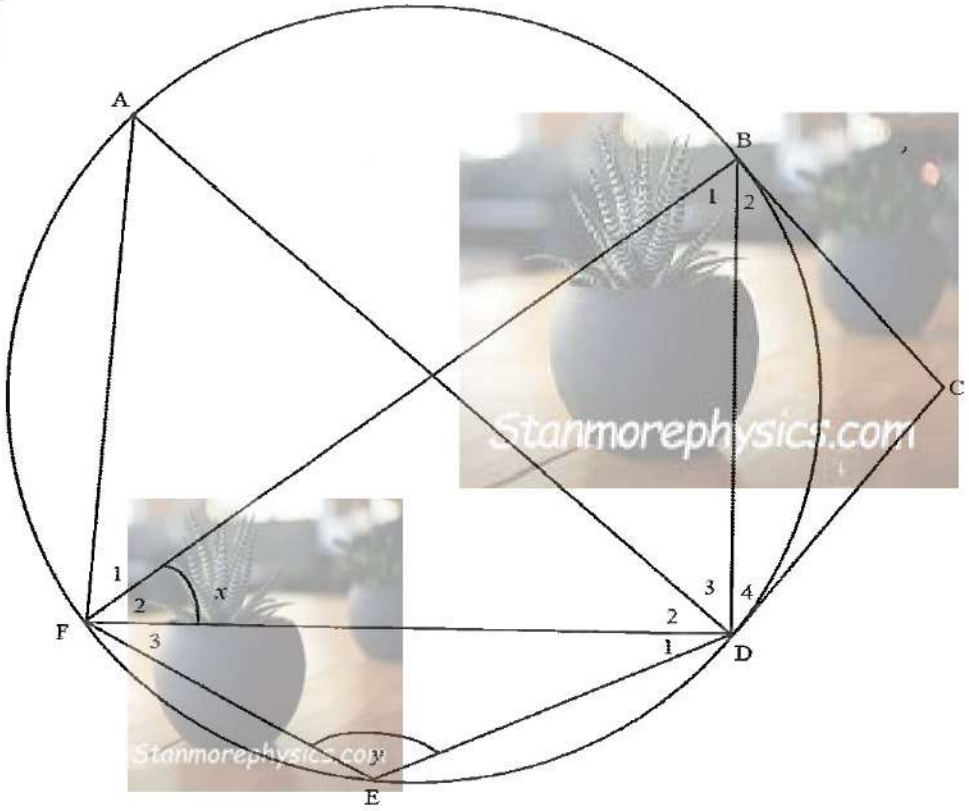
8.1 Given a circle with centre O. A, B, C, and D are points on the circle. Prove the theorem that states $\hat{A} + \hat{C} = 180°$



(6)

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8.2 In the diagram below, a circle is drawn passing through A, B, D, E and F. The tangents at B and D meet at C. $B\hat{F}D = x$ and $\hat{E} = y$.



Express the following in terms of x and y, giving reasons:

8.2.1 $\hat{B}_2$ (2)

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

8.2.3 $\hat{C}$ (2)

8.2.4 $\hat{A}$ (2)

8.2.5 $\hat{B}_1$ (2)

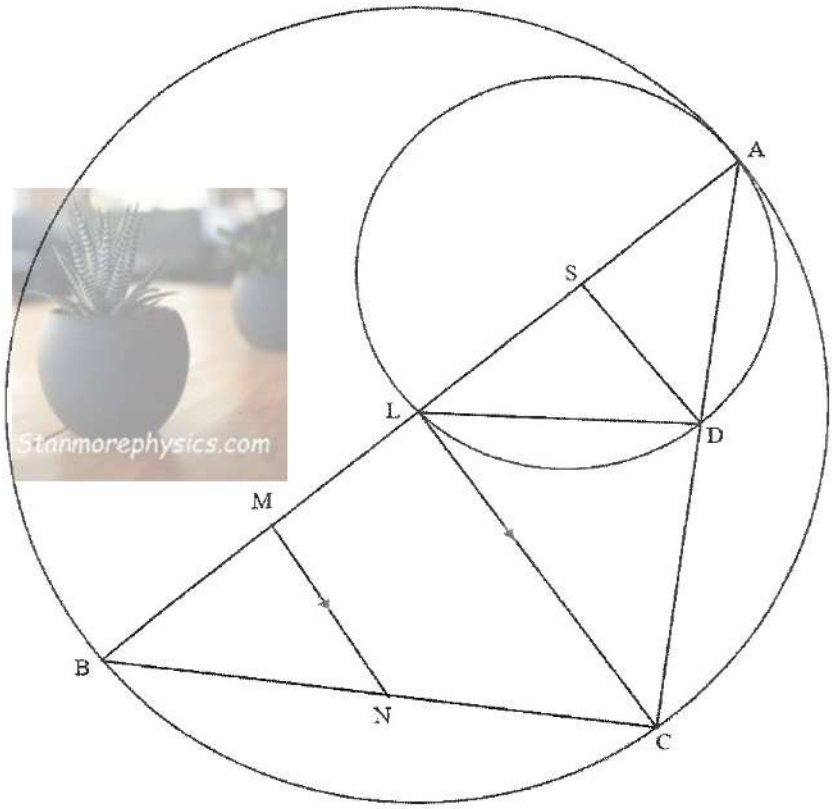
[16]

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QUESTION 9

In the diagram below, two circles touch internally at A.

- AB is the diameter of the larger circle, and AL is the diameter of the smaller circle.
- S and L are the centres of the circles.
- D is the point on the smaller circle, and C is a point on the larger circle. ADC is a straight line.
- M is a point on LB such that MN ||LC.



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9.1 Prove DL||CB. (4)

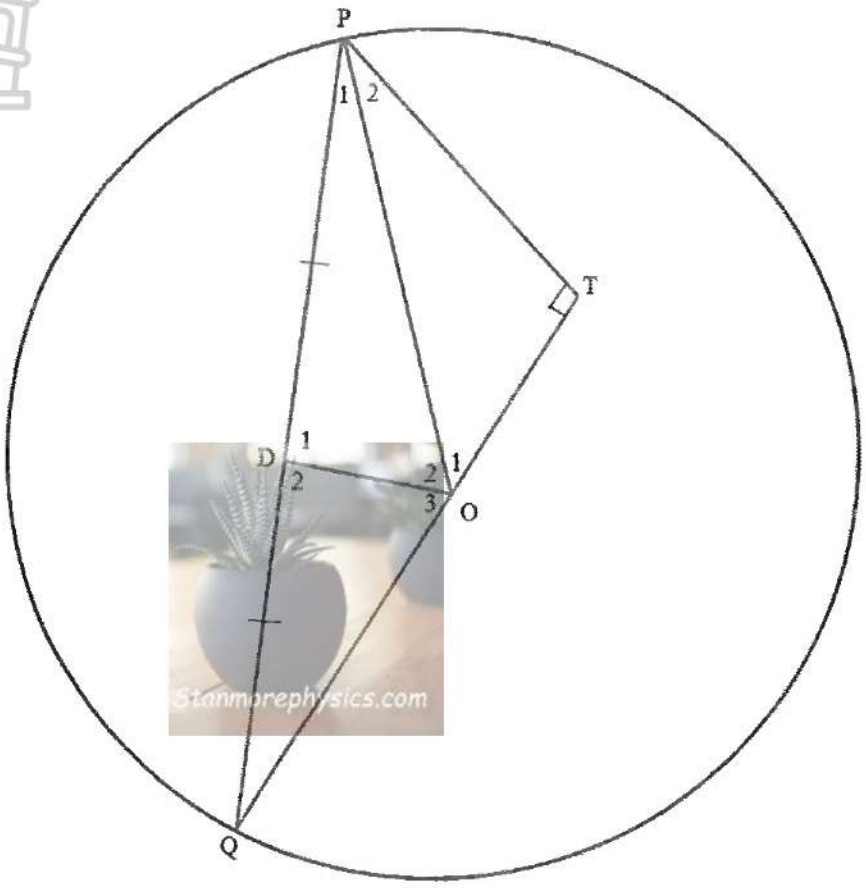
9.2 Prove that 2SD = LC (3)

9.3 Determine the value of $\frac{SL}{AB}$ (2)

9.4 Determine the length of LM, if AB is 30 units and $\frac{BN}{NC}=\frac{7}{9}$ (3)
[12]

QUESTION 10

In the diagram below Δ PQT is drawn. O is the centre of the circle, and OD bisects PQ. PT ⊥ QT.



Prove the following:

10.1 $\hat{O}_3 = Q\hat{P}T$ (5)

10.2 ΔOPD /// ΔPQT (4)

10.3 $OQ.QT = 2\ PD^2$ (6)

[15]

TOTAL: 150

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INFORMATION SHEET:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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