Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 12

SEPTEMBER 2025

MATHEMATICS P2

MARKS: 150

TIME: 3 hours

MATHE2

This question paper consists of 14 pages, including an information sheet and an answer book of 22 pages.

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 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. An information sheet with formulae is included at the end of the question paper.
9. Write neatly and legibly.

QUESTION 1

The ages (in years) of visitors that visited a bed and breakfast (B&B) on a specific day were recorded as follows.

15	17	20	20	20	21	22	24
29	29	30	$11t$	$11t+2$	36	38	55

1.1 Identify the mode of the data. (1)

1.2 It is further given that interquartile range of the ages of visitors is 14. Calculate the value of t. (3)

1.3 Calculate the mean ages of the visitors if $t = 3$. (2)

1.4 Calculate the standard deviation of the data. (1)

1.5 How many visitors have ages that are less than one standard deviation of the mean? (3)
[10]

QUESTION 2

An athlete's finishing times and the daily temperatures were tracked during 10 years of Comrades Marathon to investigate the relationship between temperature and race completion time. The table below shows the data from these 10 years.

Year	1	2	3	4	5	6	7	8	9	10
Temperatures (degrees Celsius) x	41	9	30	15	25	20	20	35	39	16
Finishing times of athlete (in minutes) y	72	30	66	29	45	43	41	66	68	31

2.1 Calculate the correlation coefficient of the data. (1)

2.2 Comment on the strength of the relationship between temperatures and finishing time. (1)

2.3 Calculate the equation of the least squares regression line of the data. (3)

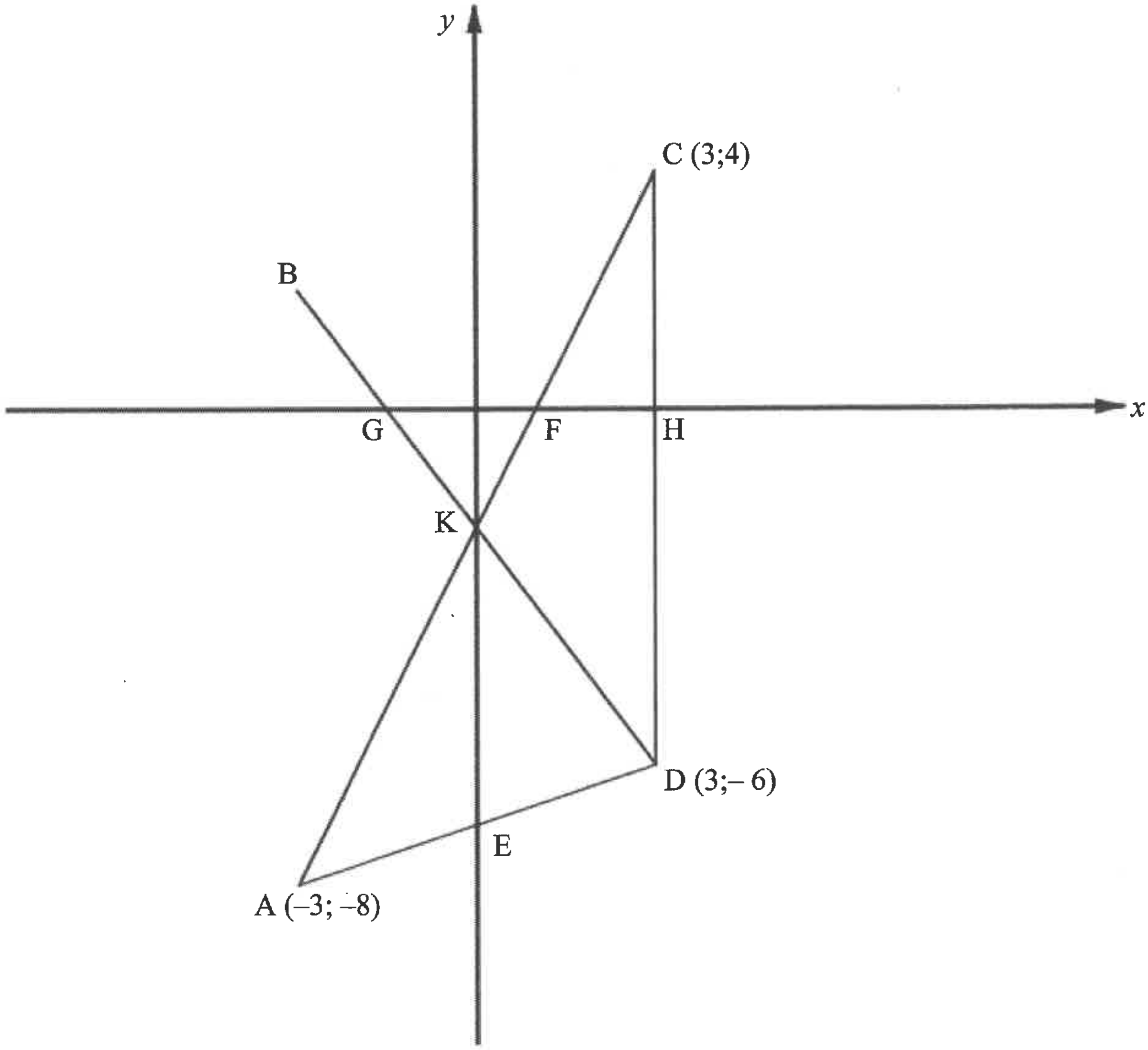
2.4 Use the equation of the least squares regression line to predict the temperatures if an athlete takes 57 minutes to finish the race. Round the answer off to the nearest whole number. (2)

2.5 Draw the least squares regression line on the grid provided in the SPECIAL ANSWER BOOK. (2)
[9]

QUESTION 3

A(–3; –8), B, C(3; 4) and D(3; – 6) are vertices of a quadrilateral. Diagonals BD and AC intersect at K. E and K are y-intercepts of AD and BD respectively. G, F and H are x-intercepts of BD, CA and CD respectively.

Equation of line BD is given by $y = -\frac{4}{3}x - 2$



3.1 Calculate the length of AC. Leave your answer in simplest surd form. (2)

3.2 Calculate the gradient of AC. (2)

3.3 Determine the equation of line AD in the form $y = \ldots$ (3)

3.4 Determine the size of $C\hat{K}D$. (5)

3.5 If it is further given that $AC = 2KC$, determine the area of ΔCKD. (5)

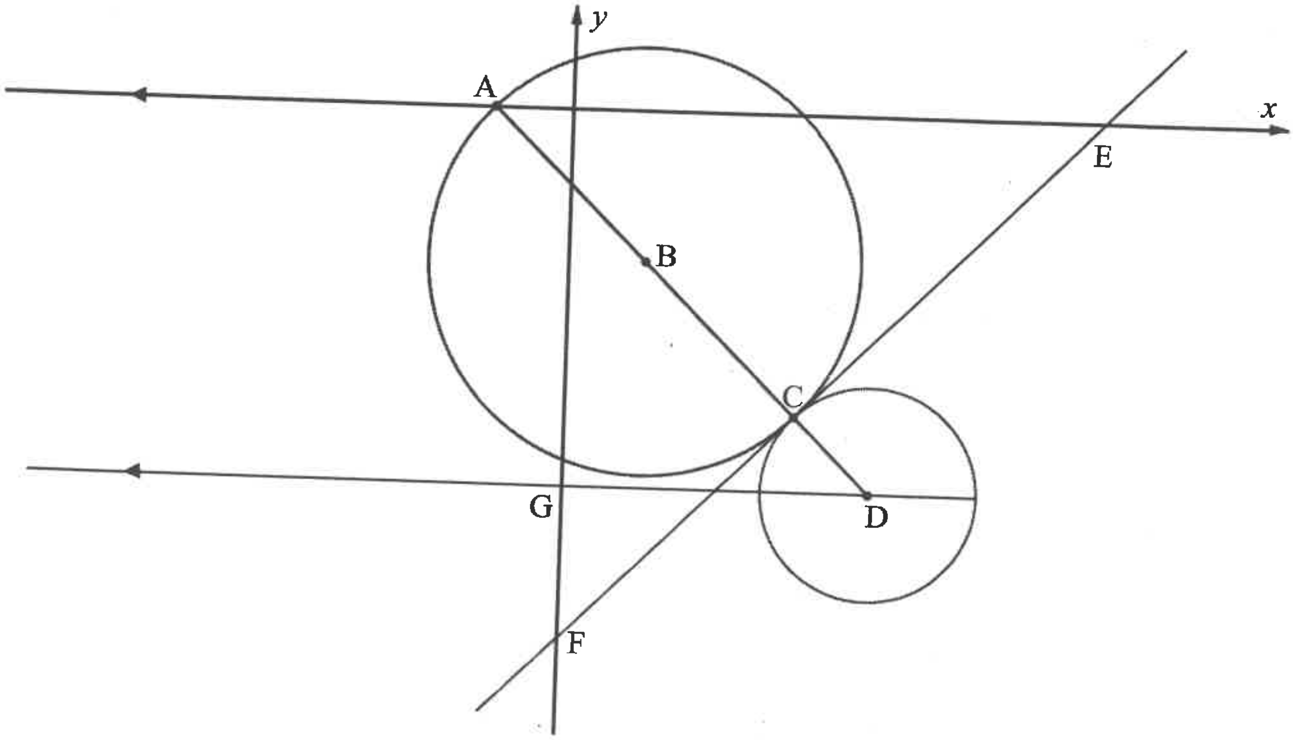
3.6 Write down the equation of CD. (1)

3.7 Determine the numerical value of $\dfrac{\text{Area of } \Delta CKD}{\text{Area of } EKCD}$ (5)

[23]

QUESTION 4

In the diagram below, $x^2+y^2-2x+4y-3=0$ is the equation of the bigger circle with centre B. Diameter ABC of the bigger circle is drawn and produced to D. GD is the line drawn parallel to the x-axis passing through D the centre of the smaller circle. FCE is a common tangent to both circles at C and intersecting x- and y-axis at E and F respectively. The equation of line GD is $y=-5$. ABCD is a straight line. AE = 8 units.



4.1 Determine the coordinates of B, the centre of the larger circle. (3)

4.2 Determine the coordinates of A, the x-intercept of the larger circle. (3)

4.3 Calculate the gradient of AB. (2)

4.4 Calculate the length of CE. (4)

4.5 Determine the coordinates of D. (4)

4.6 Determine equation of the circle with centre D in the form $(x-a)^2+(y-b)^2=r^2$ (3)

[19]

QUESTION 5

5.1 Given: $\tan\theta = -\frac{5}{4}$ where $90^0 < \theta < 270^0$. With the aid of a diagram and without using a calculator, determine the value of:

5.1.1 $\cos\theta$ (2)

5.1.2 $2\sin^2\theta$ (2)

5.1.3 $\cos(90^0 - 2\theta)$ (4)

5.2 Prove that: $\frac{3\cos 2x + 3\cos^2 x + 9\sin^2 x}{4 - 4\sin^2 x} = \frac{3}{2\cos^2 x}$ (4)

5.3 Simplify without using a calculator:

$$\frac{\cos x.\cos(90^0 - x)\sin(48^0 - x) + \sin^2 x\cos(48^0 - x)}{\sin(-x).\cos 24^0.\cos 66^0}$$ (7)

5.4 Given: $[\cos(60^0 - x) + \cos(60^0 + x)]^2$

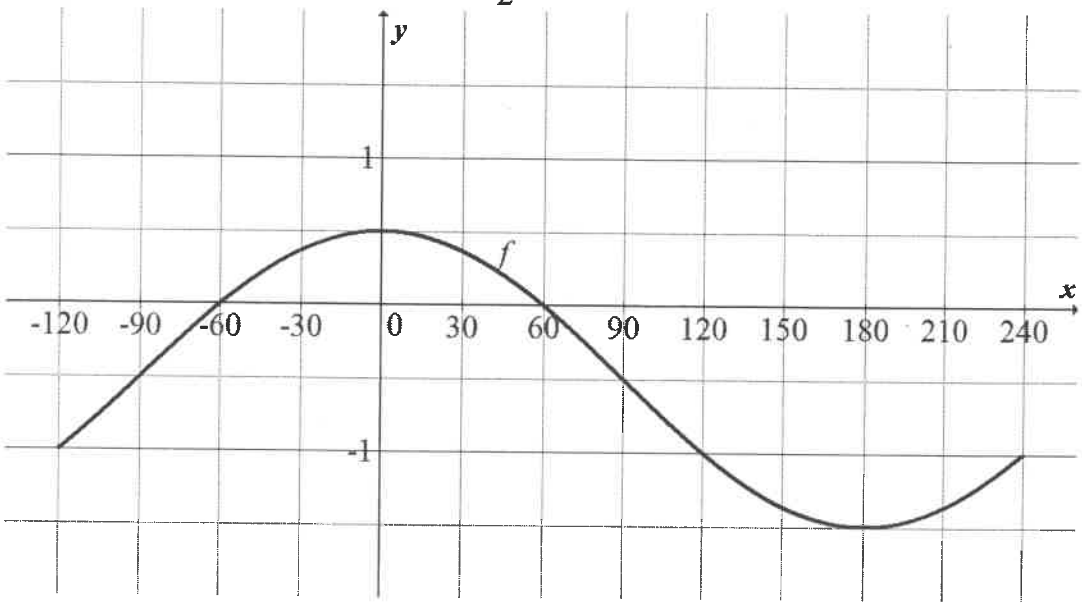
5.4.1 Simplify to a single trigonometric ratio of x:
$[\cos(60^0 - x) + \cos(60^0 + x)]^2$ (3)

5.4.2 Hence, or otherwise, determine the general solution of:
$[\cos(60^0 - x) + \cos(60^0 + x)]^2 = \frac{3}{4}$ (4)

[26]

QUESTION 6

Sketched below is the graph of $f(x)=\cos x-\frac{1}{2}$ in the interval of $x\in[-120^{0};240^{0}]$



6.1 Determine the range of $f(x)+1$ (2)

6.2 On the same set of axis, sketch the graph of $g(x)=\sin(x+30^{0})$ in the interval of $x\in[-120^{0};240^{0}]$ on the grid provided in the SPECIAL ANSWER BOOK. Clearly indicate intercepts with the axis. (3)

6.3 Write down the value(s) of x where g has a minimum value. (2)

6.4 For which values of x is $f'(x)<0$. (2)

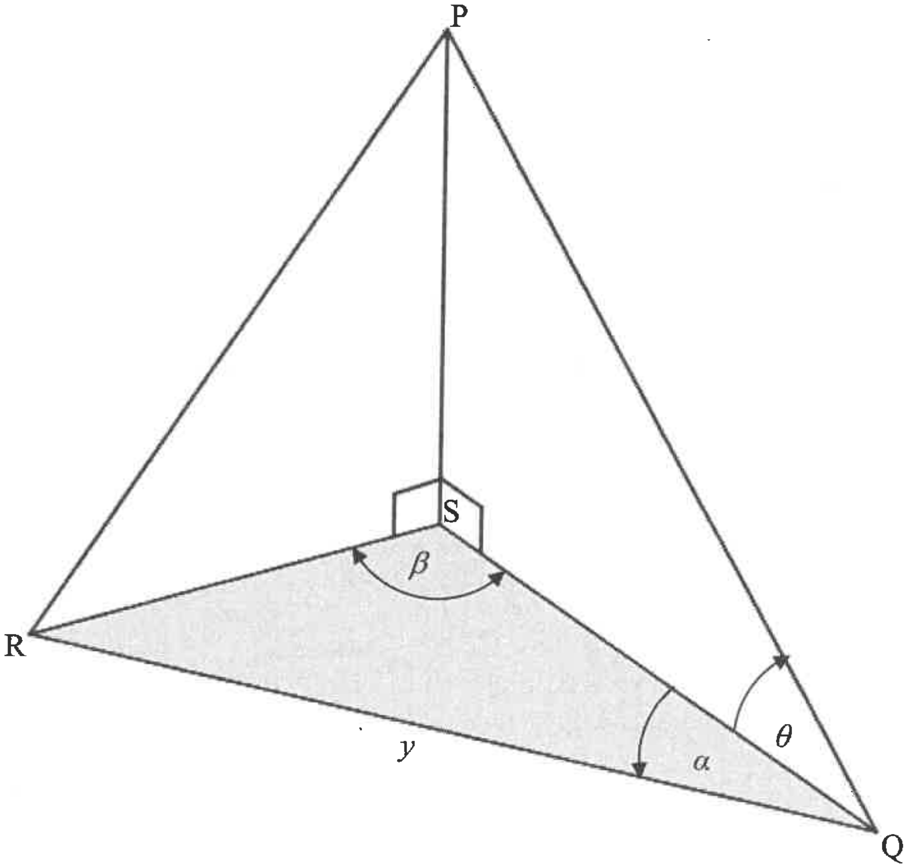
6.5 Write down the amplitude of f. (1)

6.6 Describe the transformation of f to $h(x)=-\cos x$ (2)

[12]

QUESTION 7

In the diagram below, PS is a vertical tower standing on a horizontal plane QRS.
$QR = y$, $\hat{Q}_1 = \alpha$, $\hat{Q}_2 = \theta$ and $Q\hat{S}R = \beta$.



7.1 Write down the size of $S\hat{R}Q$ in terms of β and α. (1)

7.2 Show that $PS = \dfrac{y.\tan\theta.\sin(\beta+\alpha)}{\sin\beta}$ (3)

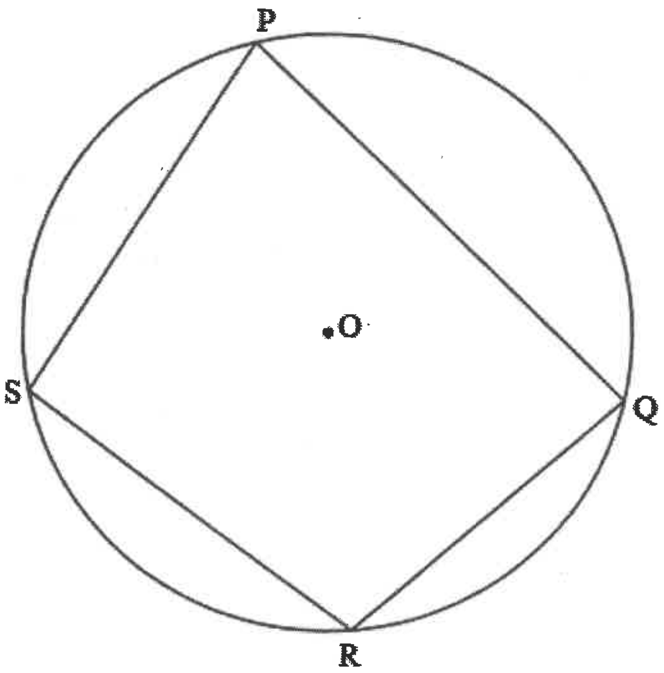
7.3 Hence or otherwise, determine the length of PS if $y = 116\text{m}$, $\theta = 57°$, $\beta = 102°$ and $\alpha = 27°$ (2)

7.4 Determine the angle of elevation from R to P. (4)

[10]

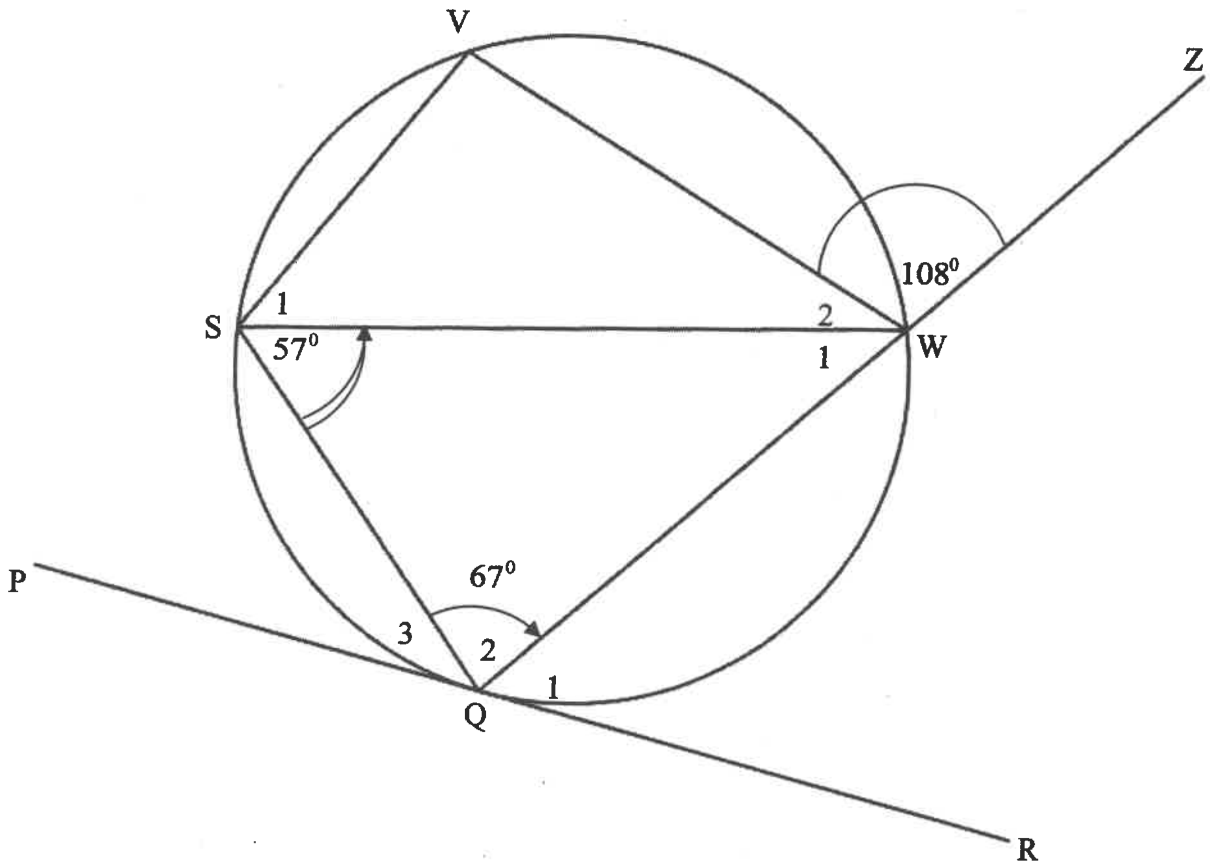
QUESTION 8

8.1 In the diagram below, O is the centre of the circle. The circle passes through the points P, Q, R and S.



Use the diagram in the ANSWER BOOK to prove the theorem which states that if PQRS is a cyclic quadrilateral then $\hat{P} + \hat{R} = 180^0$ (5)

8.2 PR is a tangent to the circle at Q. QWZ is a straight line. Q, S, V and W are points on the circumference of the circle. $V\hat{W}Z = 108°$, $Q\hat{S}W = 57°$ and $S\hat{Q}W = 67^0$.



8.2.1 Determine the size of $\hat{V}$ (2)

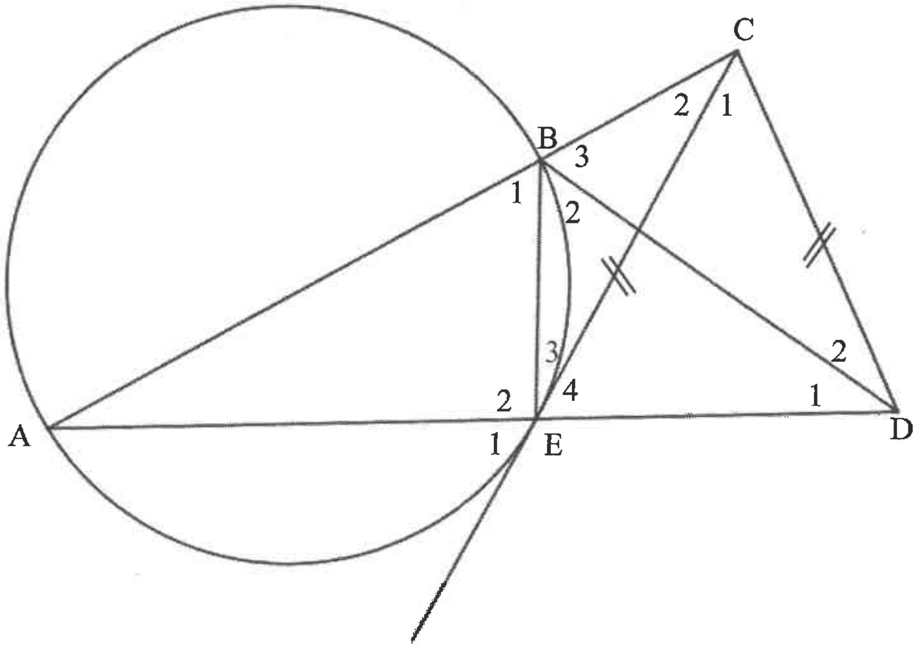
8.2.2 Determine the size of $\hat{S}_1$ (2)

8.2.3 Calculate the size of $W\hat{Q}R$ (2)

[11]

QUESTION 9

In the diagram below, A, B and E are points on the circumference of the circle. AB is produced to meet EC at C. AE is produced to meet CD at D. EC is a tangent to circle at point E. CD = EC.



Prove that:

9.1 BCDE is a cyclic quadrilateral (5)

9.2 $\Delta CEB \mathbin{|||} \Delta CAE$ (3)

9.3 $CD = \frac{EB.AC}{AE}$ (2)

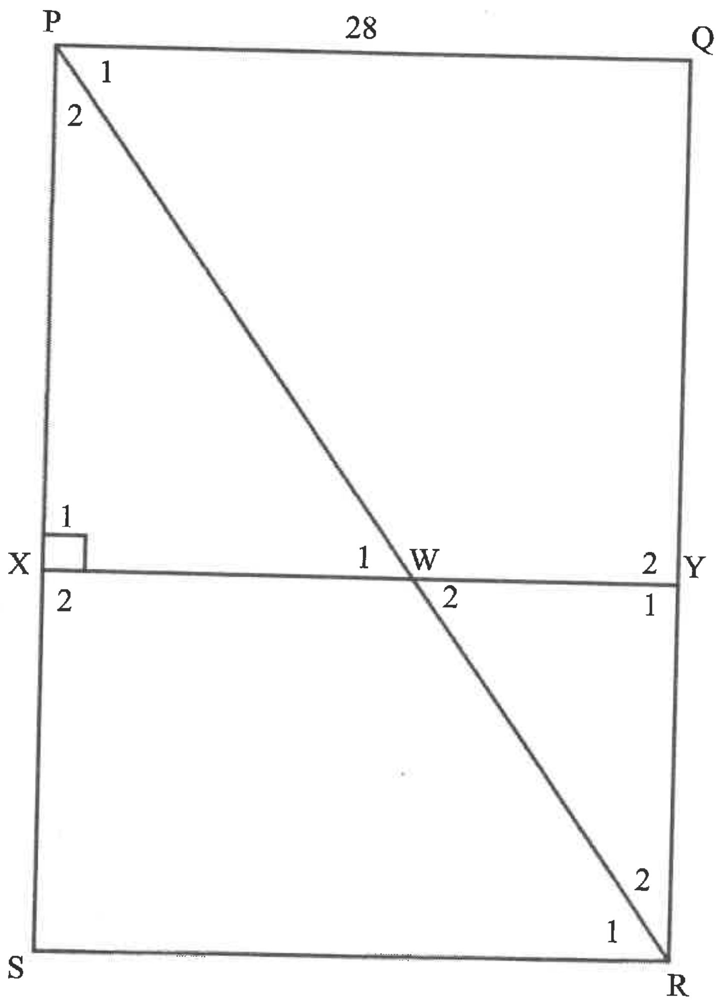
9.4 CD is a tangent to circle ABD (3)

9.5 $\frac{EB^2}{AE^2} = \frac{BC}{AC}$ (6)

[19]

QUESTION 10

In the diagram below, PQRS is a rectangle. PR intersect XY at W. $XY \perp PS$.
$QY:YR = 4:3$. $PQ = 28$ units and $PR = 42$ units.



10.1 Prove that $XY \parallel PQ$. (2)

10.2 Determine, with reasons, the length of WR. (4)

10.3 Determine the length of XW. (5)

[11]

TOTAL: 150

INFORMATION SHEET: MATHEMATICS

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

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

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

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

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

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

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

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

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

In ΔABC: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ $a^2 = b^2 + c^2 - 2bc.\cos A$ $area\,\Delta ABC = \frac{1}{2}ab.\sin C$

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

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

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

$\bar{x} = \frac{\sum x}{n}$ $\sigma^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n}$ $P(A) = \frac{n(A)}{n(S)}$ $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

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