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TOTAL MARKS

NATIONAL SENIOR CERTIFICATE EXAMINATION
MAY 2025

MATHEMATICS: PAPER II

EXAMINATION NUMBER

Time: 3 hours

150 marks

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of 24 pages and an Information Sheet of 2 pages (i–ii). Please check that your question paper is complete.
2. Read the questions carefully.
3. **Answer ALL the questions on the question paper and hand it in at the end of the examination. Remember to write your examination number in the space provided.**
4. Diagrams are not necessarily drawn to scale.
5. You may use an approved non-programmable and non-graphical calculator, unless otherwise stated.
6. Ensure that your calculator is in **DEGREE** mode.
7. Clearly show **ALL** calculations, diagrams, graphs, etc. that you have used in determining your answers. **Answers only will NOT necessarily be awarded full marks.**
8. Round off to **TWO DECIMAL PLACES** unless otherwise stated.
9. It is in your own interest to write legibly and to present your work neatly.
10. Three blank pages (page 22 to 24) are included at the end of the paper. If you run out of space for a question, use these pages. Clearly indicate the number of your answer should you use this extra space.

FOR OFFICE USE ONLY: MARKER TO ENTER MARKS

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	TOTAL
11	12	17	11	10	17	15	12	6	7	6	16	10	/150

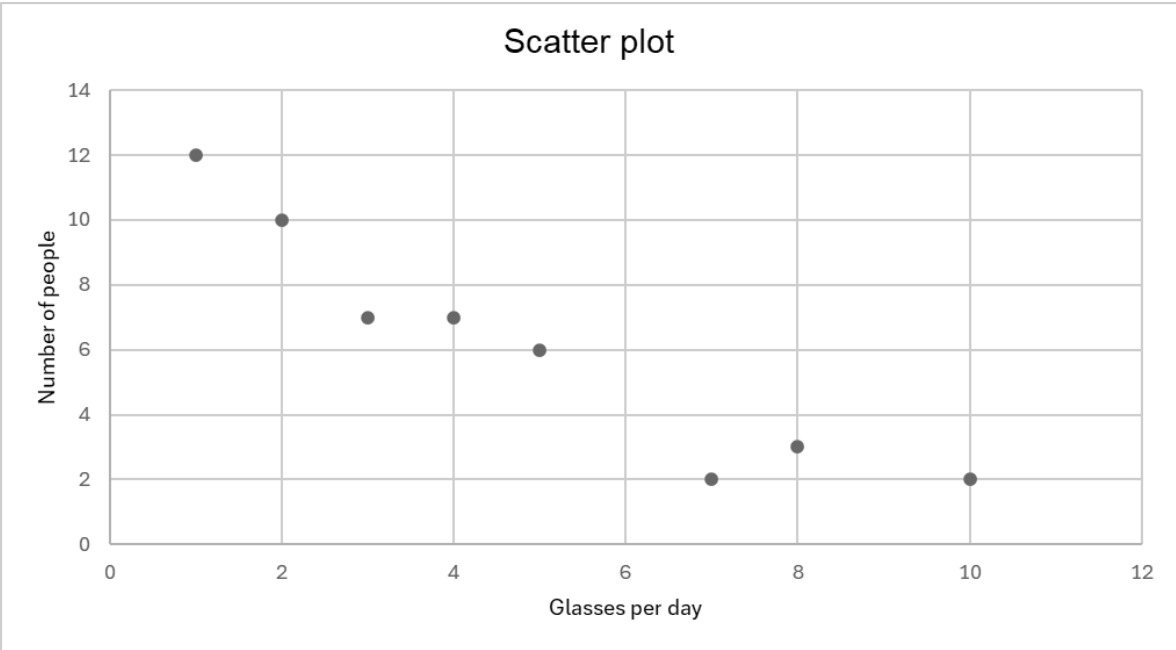
N12MATH-2-E

SECTION A

QUESTION 1

The table below illustrates the results of a survey done to establish how many glasses of water people drink per day.

Glasses of water per day (x)	1	2	3	4	5	7	8	10
Number of people (y)	12	10	7	7	6	2	3	2



(a) Use your calculator to determine the equation for the line of best fit in the form $y = a + bx$, correct to three decimal places. (3)

(b) Sketch your line of best fit on the scatter plot above. Clearly indicate the coordinate $(\bar{x}\,;\,\bar{y})$ on your graph, as well as the y-intercept. (4)

(c) Calculate the correlation coefficient (correct to 3 decimal places), and comment on what this suggests about the data. (2)

(d) Use your answer in (a) to estimate how many people drink 15 glasses of water per day. Comment on your answer. (2)

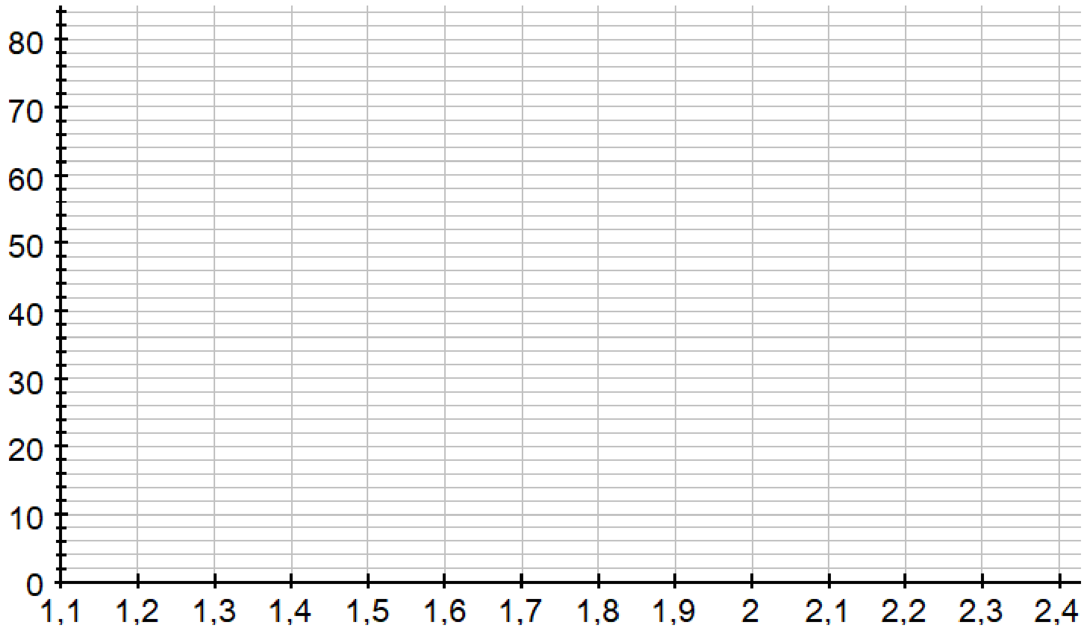
[11]

QUESTION 2

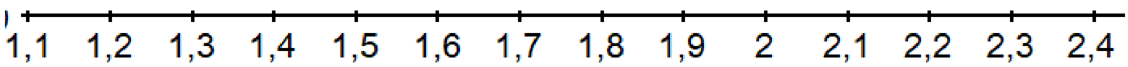
Learners were surveyed to determine the distance between their homes and school. The shortest distance was recorded as 1,39 km and the furthest distance was 2,21 km. 80 responses are recorded in the table below.

Distance from home	**Number of learners**
$1{,}3 \leq x < 1{,}5$	12
$1{,}5 \leq x < 1{,}7$	36
$1{,}7 \leq x < 1{,}9$	16
$1{,}9 \leq x < 2{,}1$	11
$2{,}1 \leq x < 2{,}3$	5

(a) On the grid below, draw an ogive for the data. (4)



(b) Using your ogive to estimate the quartiles, draw a box-and-whisker diagram for the data. (5)



(c) Describe the skewness of the data. (1)

(d) After careful analysis of the table above, it was noticed that 5 responses were never recorded. The missing values all lay in the interval $1{,}1 \leq x < 1{,}3$. The corrected table with 85 responses is given below.

Distance from home	**Number of learners**
$1{,}1 \leq x < 1{,}3$	5
$1{,}3 \leq x < 1{,}5$	12
$1{,}5 \leq x < 1{,}7$	36
$1{,}7 \leq x < 1{,}9$	16
$1{,}9 \leq x < 2{,}1$	11
$2{,}1 \leq x < 2{,}3$	5

What effect would the additional data have on the estimated mean and the median interval of the data? (2)

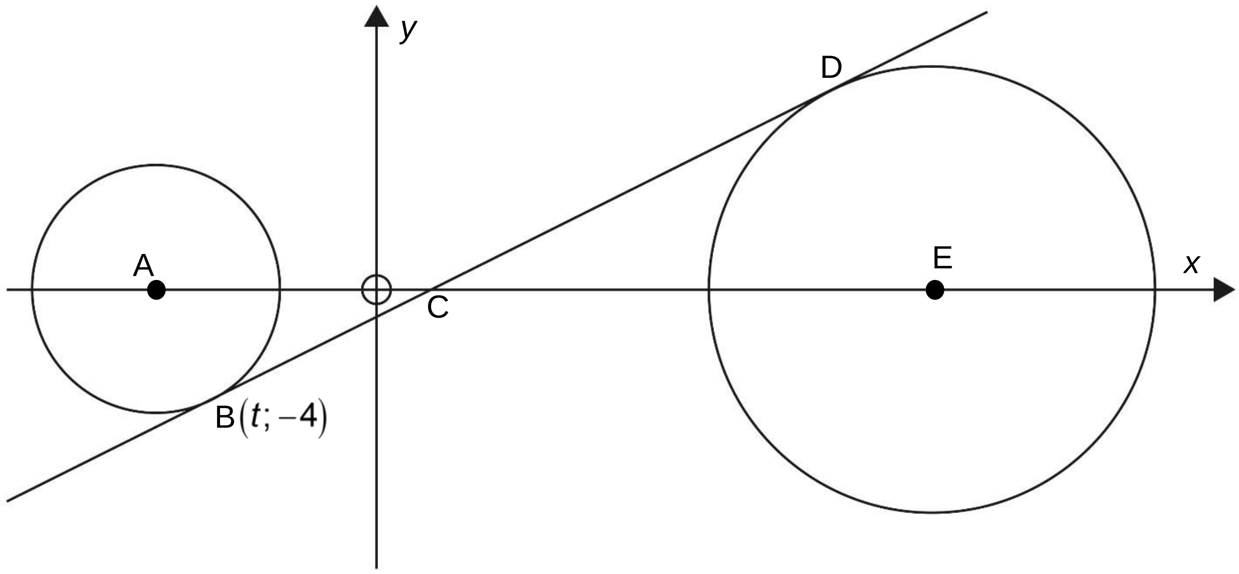
[12]

QUESTION 3

In the diagram below, two circles with centres A and E are drawn.
BCD is a common tangent to both circles at B and D respectively.
The equation of circle A is $(x+8)^2+y^2=20$.

C is the x-intercept of the tangent and B is the point $(t;-4)$.

Points A and E are 28 units apart.



(a) Show that $t=-6$. (3)

(b) (1) Calculate the gradient of AB. (2)

(2) Calculate the size of $C\hat{A}B$. (2)

(c) Determine the equation of tangent BCD. (3)

(d) Calculate the length of CE. (3)

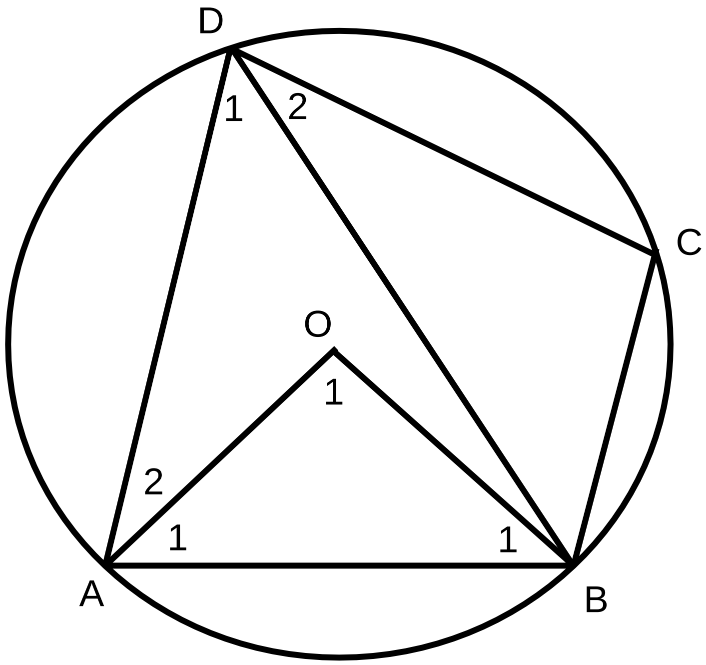
(e) Calculate the area of ΔABC. (4)

[17]

QUESTION 4

(a) In the diagram, O is the centre of the circle.

$\hat{A}_1 = \hat{A}_2 = x$.



Reasons must be given in this question.

Express the following in terms of *x*:

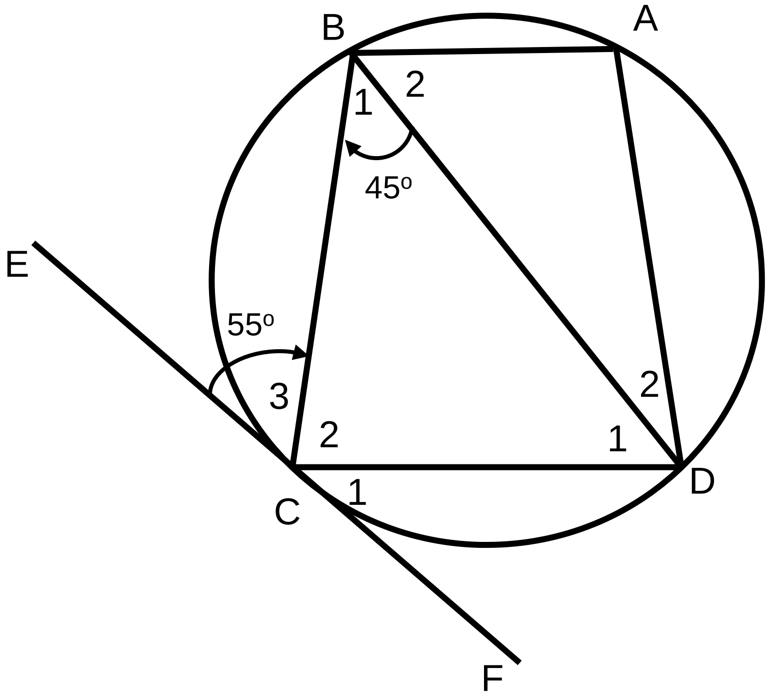
(1) $\hat{B}_1$ (1)

(2) $\hat{O}_1$ (1)

(3) $\hat{D}_1$ (2)

(4) $\hat{C}$ (2)

(b) In the diagram below, ECF is a tangent to the circle at C.
$\hat{B}_1 = 45^\circ$ and $\hat{C}_3 = 55^\circ$.
A, B, C and D lie on the circumference of the circle.



Reasons must be given in this question.

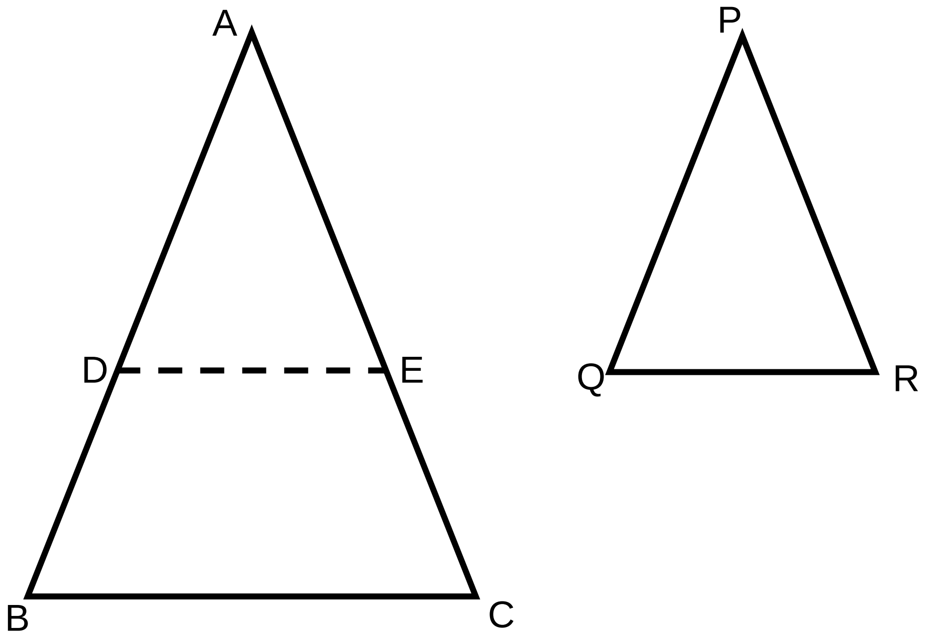
(1) Determine the size of $\hat{D}_1$. (2)

(2) Determine the size of $\hat{A}$. (3)

[11]

QUESTION 5

(a) In the diagram below, ΔABC and ΔPQR are drawn.
$\hat{A} = \hat{P}$, $\hat{B} = \hat{Q}$ and $\hat{C} = \hat{R}$.



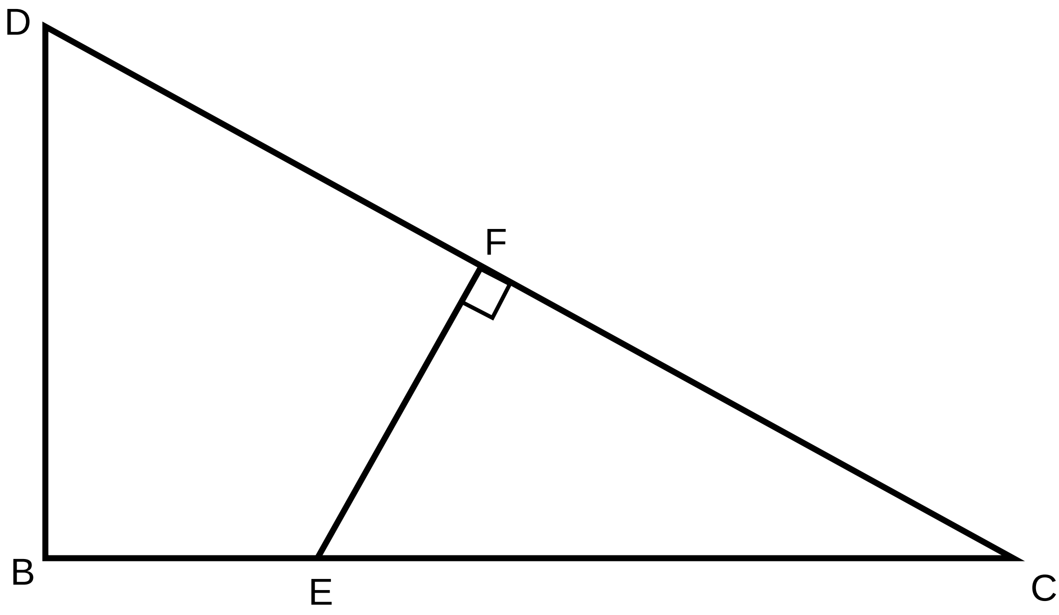
DE is drawn such that $AD = PQ$ and $AE = PR$.

Reasons must be given in this question.

(1) Why is $\Delta ADE \equiv \Delta PQR$? (1)

(2) Hence, prove that $\frac{AB}{PQ} = \frac{AC}{PR}$. (5)

(b) In $\triangle DBC, \hat{B} = 90^\circ$ and $EF \perp DC$.



Reasons must be given in this question.

Prove: $\dfrac{CB}{CD} = \dfrac{CF}{CE}$. (4)

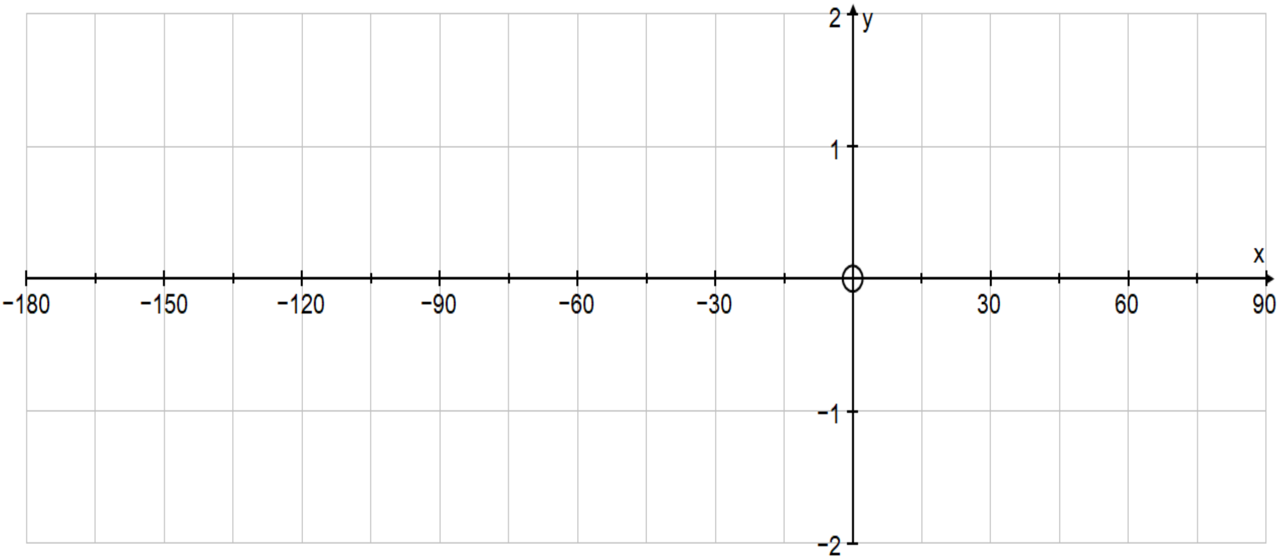
[10]

QUESTION 6

Given: $f(x) = \sin(x - 30°)$ and $g(x) = \cos 2x$.

(a) Solve $f(x) = g(x)$ where $x \in [-180°; 90°]$. (6)

(b) Sketch the graphs of f and g on the axes below. Clearly label the endpoints, and y-intercepts. (8)



(c) Using your graph, determine the values of x in the interval for which $\frac{f(x)}{g(x)} > 0$. (3)

[17]

78 marks

SECTION B

QUESTION 7

(a) Simplify to a single trigonometric ratio:

$$\frac{\sin\left(90^\circ-\beta\right)\cdot\sin\left(-\beta\right)}{\cos\left(360^\circ-\beta\right)\cdot\tan\left(-180^\circ-\beta\right)}$$ (6)

(b) (1) Prove that $\frac{\cos A + \sin A}{\cos A - \sin A} - \frac{\cos A - \sin A}{\cos A + \sin A} = 2\tan 2A$ (6)

(2) Determine all the values of A for which the identity is not valid. (3)

[15]

QUESTION 8

(a) Given: $\cos 2\theta = \dfrac{3}{5}$ and $0° < \theta < 90°$.

Determine the value of $\cos\theta$, without using a calculator. (4)

(b) Given: $\cos A = \dfrac{\sqrt{3}}{2}$ and $\cos B = \dfrac{2}{3}$.

If $\hat{A} + \hat{B} + \hat{C} = 180°$, determine the value of $\cos C$, without using a calculator. (8)

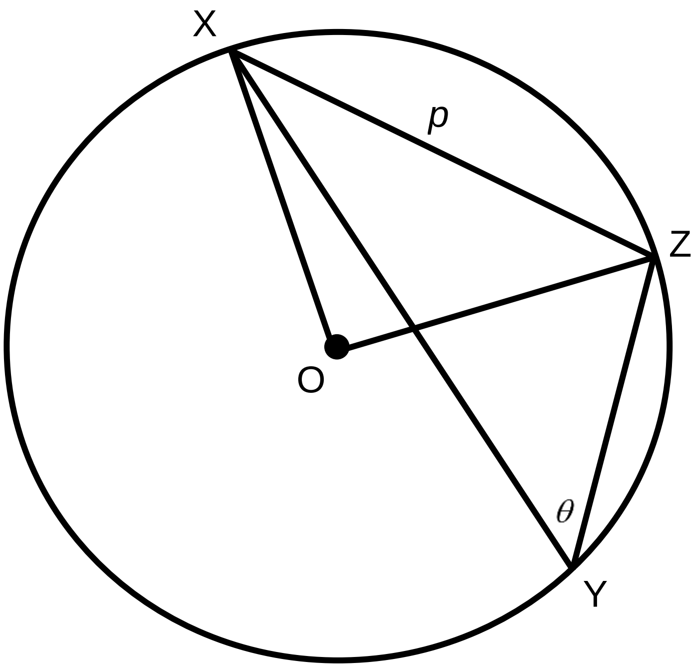
[12]

QUESTION 9

In the diagram below, ΔXYZ is inscribed in circle centre O.

The radius of the circle is r units and XZ = p units.

$\hat{Y} = \theta$.



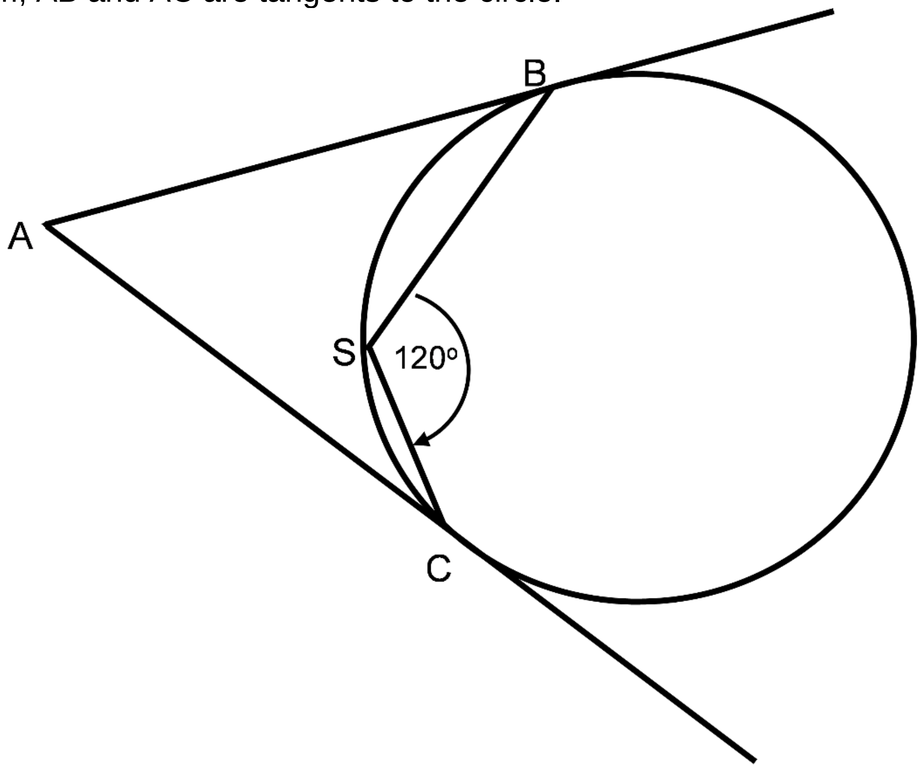
Prove: $\sin\theta = \dfrac{p}{2r}$ (6)

[6]

QUESTION 10

Reasons must be given in this question.

In the diagram, AB and AC are tangents to the circle.



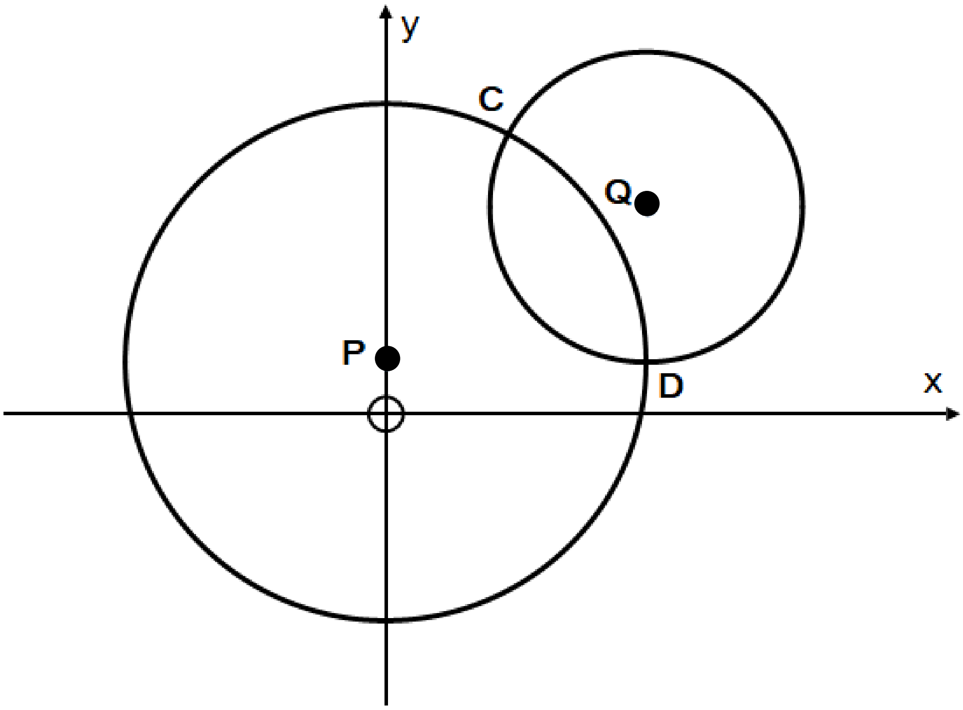
If $\hat{S} = 120°$, determine the size of $\hat{A}$. (7)

[7]

QUESTION 11

In the diagram below two circles are drawn.

The equation of circle P is $x^2 + (y-1)^2 = 25$.
The equation of circle Q is $(x-5)^2 + (y-4)^2 = 9$.
D and C are the points of intersection of the circles.
QD is a vertical tangent to the circle at D.



If PQ bisects CD, determine the equation of the common chord CD. (6)

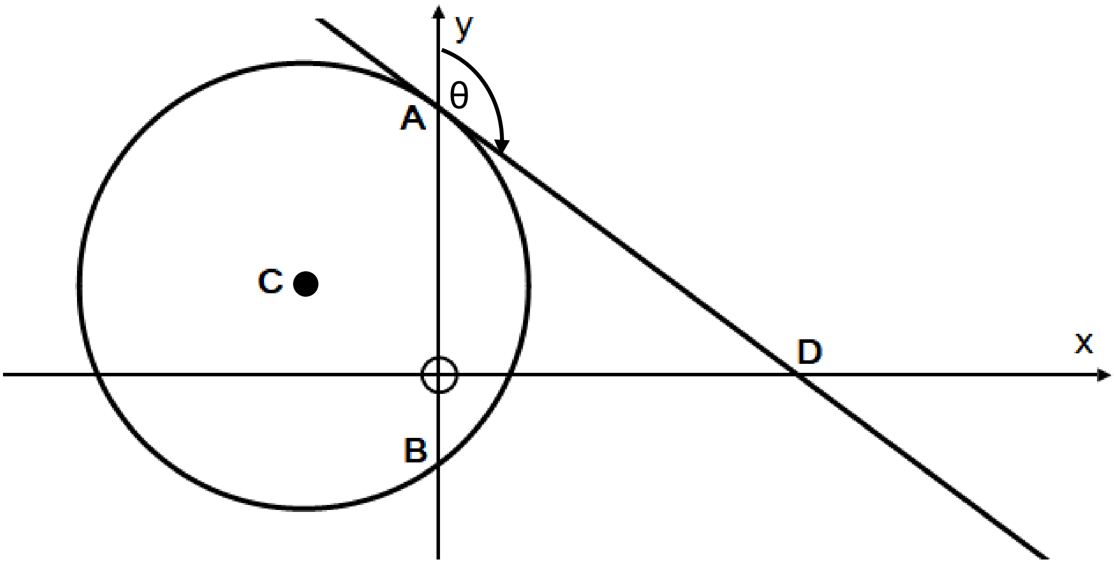
[6]

QUESTION 12

The diagram shows circle centre C with equation $x^2 + y^2 + 6x - 4y = 12$.

A and B are the *y*-intercepts of the circle.

AD is a tangent to the circle at A, and its *x*-intercept is D.



(a) Determine the size of θ, the angle the tangent makes with the y-axis. (8)

(b) A second circle is to be drawn with the following requirements:

- The circle must be centred at A.
- It must pass through D on the x-axis.

Determine the equation of this circle **and** show that the two circles **touch** each other internally. (8)

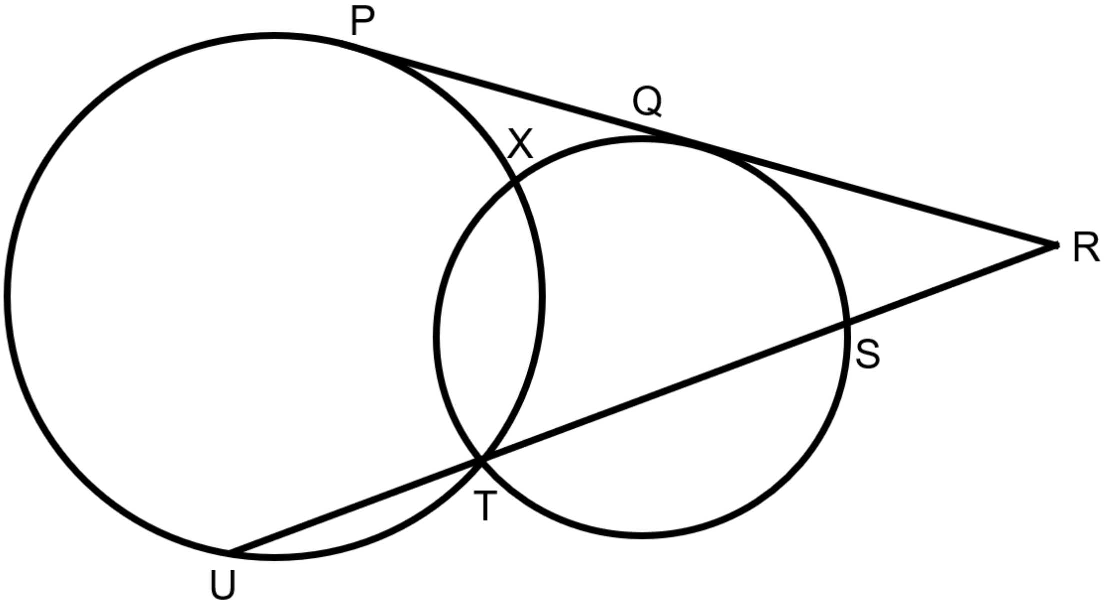
[16]

QUESTION 13

Reasons need not be given in this question.

Refer to the diagram below.

Two circles intersect at X and T.
PQR is a tangent to both circles.
$PQ = QR$.
RSTU is a secant to the circles.



Prove the following:

(a) $RQ^2 = RS \times RT$ (4)

(b) RU = 4RS (6)

[10]

72 marks

Total: 150 marks

ADDITIONAL SPACE (ALL QUESTIONS)

REMEMBER TO CLEARLY INDICATE AT THE QUESTION THAT YOU USED THE ADDITIONAL SPACE TO ENSURE THAT ALL ANSWERS ARE MARKED.