



PERCENTAGE

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PRELIMINARY EXAMINATION

MATHEMATICS: PAPER 2

NAME AND SURNAME

CLASS

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Time: 3 hours

150 marks

Examiner: J Ruiz-Mesa

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This paper consists of 27 pages and an Information Sheet. Please check that your paper is complete.
2. Read the questions carefully.
3. Answer all the questions. Write your answers in the spaces provided.
4. You may use an approved non-programmable and non-graphical calculator unless otherwise stated.
5. Clearly show **ALL** calculations, diagrams, graphs, etc. that you have used in determining your answers.
6. Diagrams are not necessarily drawn to scale.
7. If necessary, round off answers to **ONE** decimal place, unless otherwise stated.
8. It is in your own interest to write legibly and to present your work neatly.
9. If you run out of space for a question, use the additional space provided at the end. Clearly indicate the question number of your answer should you use this extra space.

FOR OFFICE USE ONLY: MARKER TO ENTER MARKS

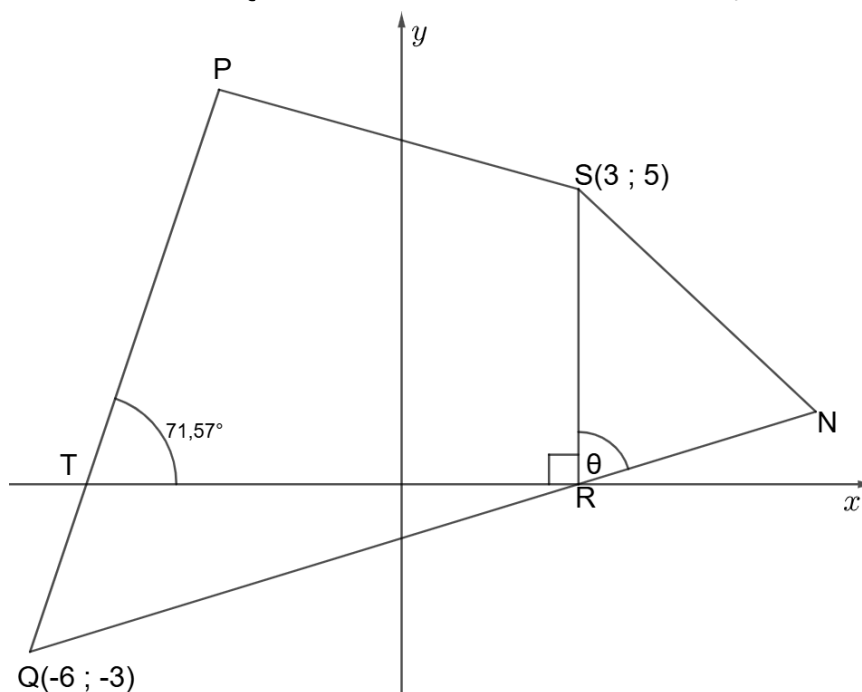
Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	TOTAL
19	12	12	18	14	13	15	20	7	12	8	/150
SECTION A = 75					SECTION B = 75					%	

PLEASE TURN OVER

SECTION A

QUESTION

In the diagram, P , $Q(-6;-3)$, R and $S(3;5)$ are the vertices of a quadrilateral. R is a point on the x -axis. QR is produced to N such that $QR = 2RN$. SN is drawn. $\hat{PTO} = 71,57^\circ$ and $\hat{SRN} = \theta$.



(a) Write down the equation of SR .

(1)

(b) Determine the gradient of QP to the nearest integer.

(2)

(c) Hence, or otherwise, determine the equation of QP .

(2)

PLEASE TURN OVER

(d) Calculate the length of QR. Leave your answer in surd form.

(2)

(e) Calculate the value of θ .

(3)

(f) Calculate the area of $\triangle RSN$.

(4)

(g) Determine the equation of the circle with centre at R and passing through N.

(3)

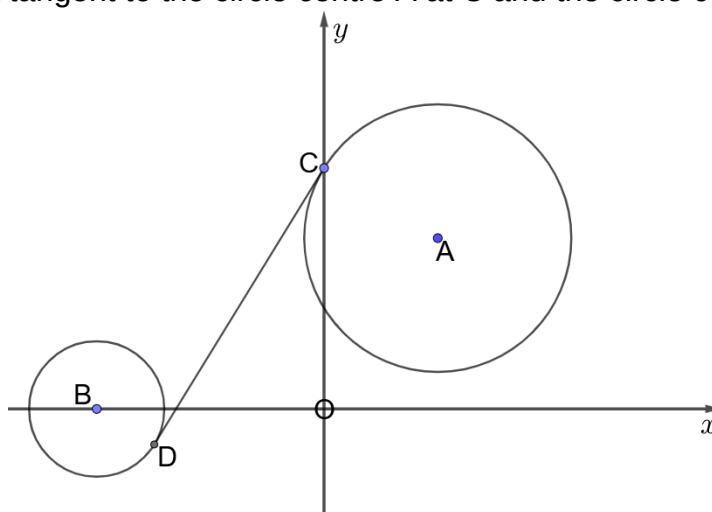
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- (h) State whether the point S lies inside or outside the circle centre R passing through N. Give a reason for your answer.

(2)
[19]

QUESTION 2

In the diagram below, two circles with equations $x^2 + y^2 - 8x - 12y + 27 = 0$ and $(x + 8)^2 + y^2 = 1$ are drawn (not to scale). CD is a tangent to the circle centre A at C and the circle centre B at D. C is a point on the y-axis.



- (a) Determine the coordinates of A.

(2)

- (b) Write down the equation of the tangent to the circles

(6)

PLEASE TURN OVER

(c) Determine the length of the tangent CD.

(4)
[12]

PLEASE TURN OVER

QUESTION 3

- (a) A skydiver jumps out of a plane. His height above the ground was recorded at various times after his parachute was released. The information is captured in the table below where y represents his height above the ground (in metres) and t represents the time (in seconds) after the parachute was deployed.

t (seconds)	2	3	4	5	6	7	8
y (metres)	500	300	200	120	70	40	20

- (1) Determine the equation of the least squares regression line for this data.

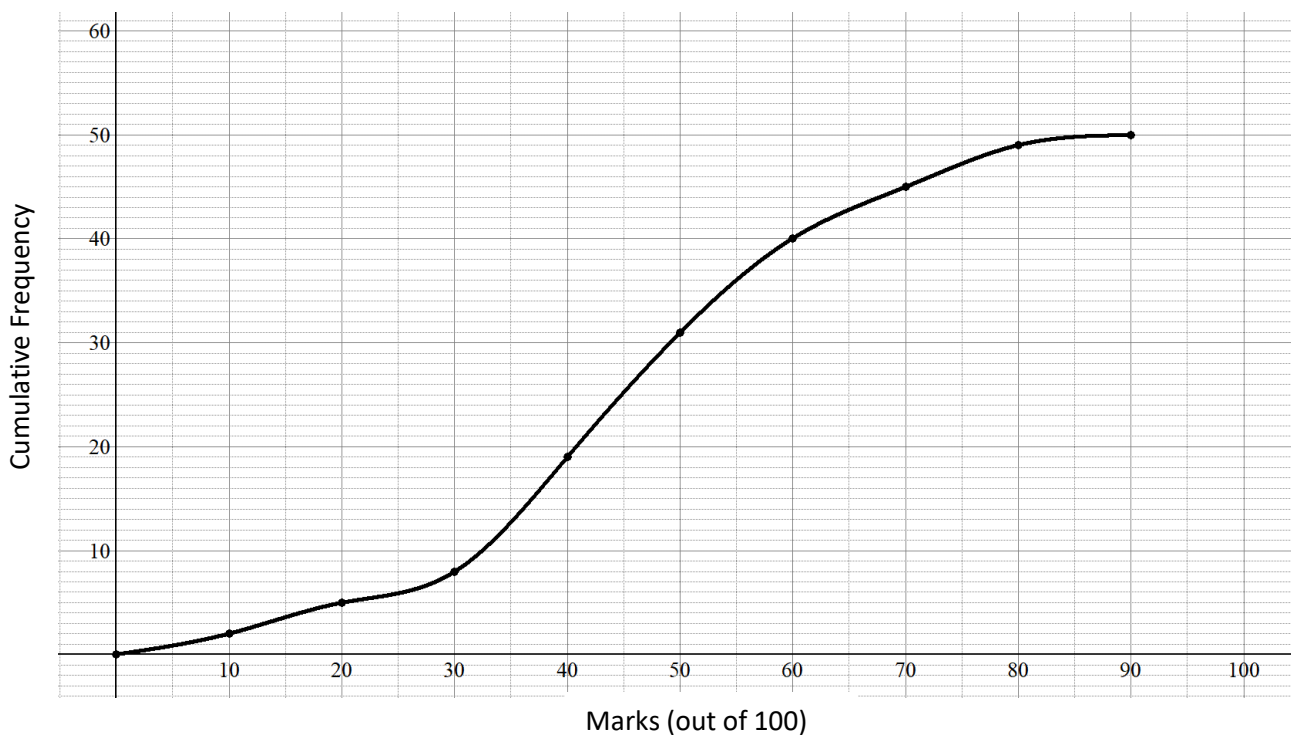
- (2) Write down the correlation coefficient and comment on the strength of the relationship. (3)

- (3) Determine the height of the skydiver above the ground one second after deploying the parachute and comment on the reliability of your answer. (3)

(2)

PLEASE TURN OVER

- (b) The diagram below show the cumulative frequency curve (ogive) showing the performance of the grade 12 class in a recent assessment.



(1) How many students wrote the assessment?

(1)

(2) How many students achieved a mark above 70% for the assessment?

(1)

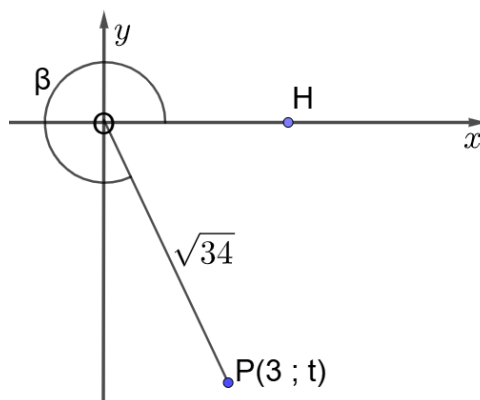
(3) Only the top 20% of the students qualify for the Further Studies Mathematics course. Write down the minimum mark required for a student to qualify for the Further Studies course?

(2)
[12]

PLEASE TURN OVER

QUESTION 4

- (a) In the diagram below, $P(3;t)$ is a point in the Cartesian plane. $OP = \sqrt{34}$ and $\widehat{HOP} = \beta$ is a reflex angle.



Determine, without using a calculator, the value of:

(1) t

(2) $\tan \beta$

(3) $\cos 2\beta$

(2)

(1)

(3)

PLEASE TURN OVER

(b) Given that $\sin 68^\circ = p$, determine the following in terms of p :

(1) $\cos 338^\circ \cdot \sin 248^\circ$

(2) $12 \sin 17^\circ \cdot \cos 17^\circ \cdot \cos 34^\circ$

(3)

(c) Simplify, without the use of the calculator:

(3)

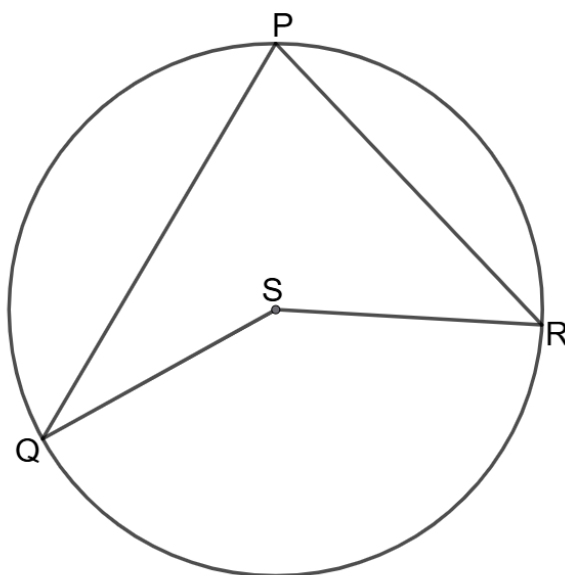
$$\sqrt{\frac{\sin(180^\circ - 2x) \cdot \cos 300^\circ}{\cos(90^\circ + x) \cdot \cos(180^\circ + x)} - \cos^2(360^\circ - x)}$$

(6)
[18]

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QUESTION 5

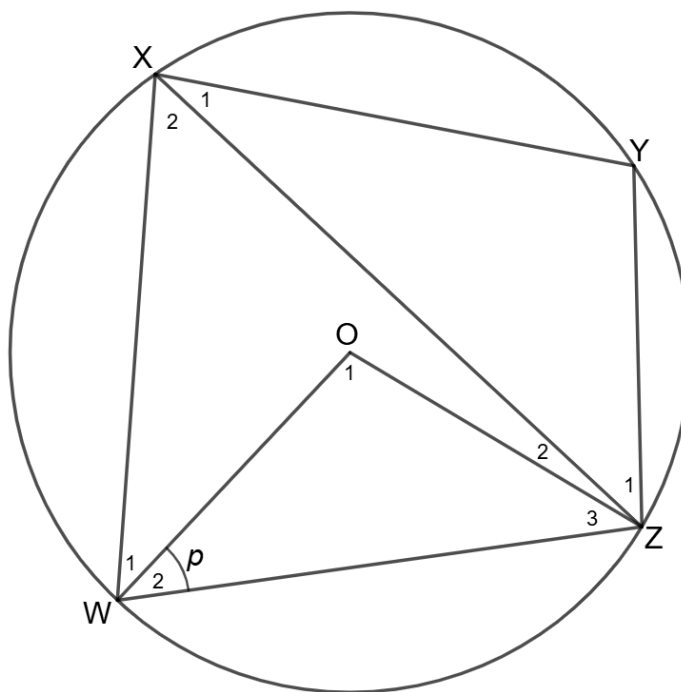
- (a) In the diagram below, S is the centre of the circle through P, Q and R. Use the diagram to prove the theorem that states: $\hat{QSR} = 2 \times \hat{QPR}$.



(6)

PLEASE TURN OVER

- (b) In the diagram below, O is the centre of the circle. WXYZ is a cyclic quadrilateral such that OW bisects $\hat{XWZ}$. XZ is joined and $\hat{W}_2 = p$.



- (1) Determine, with reason, two other angles equal to p .

(3)

- (2) Write $\hat{Y}$ in terms of p .

(2)

- (3) Express $\hat{X}_2$ in terms of p .

(3)
[14]

Section A: **75 marks**

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SECTION B**QUESTION 6**

(a) Given that $\sin(A+B) - \sin(A-B) = 2\cos A \sin B$

(1) Prove the identity.

(2)

(2) Hence evaluate, without the use of a calculator: $\cos 52,5^\circ \cdot \sin 7,5^\circ$

(3)

PLEASE TURN OVER

(b) Given that $\frac{\sin \theta}{\cos \theta - \sin \theta} + \frac{\sin \theta}{\cos \theta + \sin \theta} = \tan 2\theta$

(1) Prove the identity.

(5)

(2) Hence determine the general solution of:

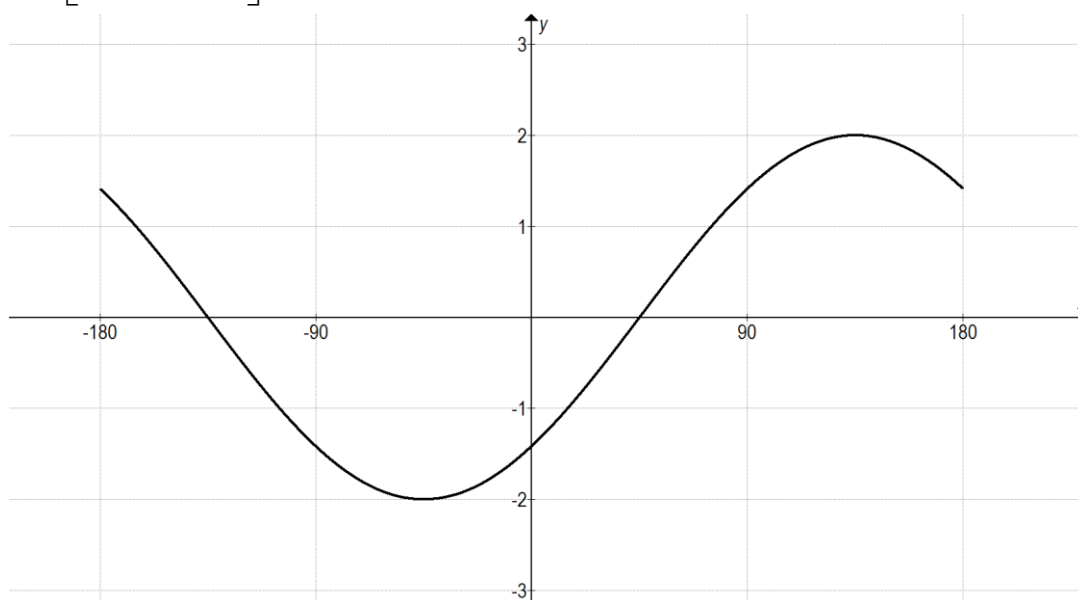
$$\frac{\sin \theta}{\cos \theta - \sin \theta} + \frac{\sin \theta}{\cos \theta + \sin \theta} = -4$$

(3)
[13]

PLEASE TURN OVER

QUESTION 7

- (a) In the diagram below the graph of $f(x) = 2\sin(x - 45^\circ)$ is drawn in the interval $x \in [-180^\circ; 180^\circ]$.



(1) Write down the amplitude of f .

(1)

(2) Determine the values of x , in the interval $x \in [-180^\circ; 180^\circ]$ for which $f'(x) \geq 0$.

(2)

(3) On the same set of axes, draw the graph of $g(x) = -\tan x$, $x \in [-180^\circ; 180^\circ]$

(3)

(4) Write down the value of $g(-45^\circ) - f(-45^\circ)$.

(1)

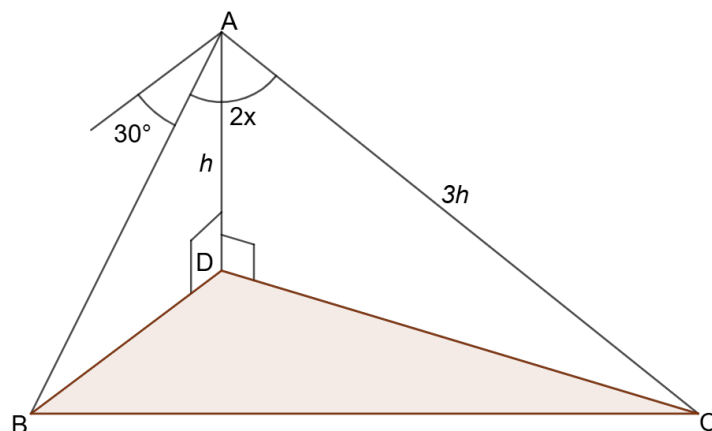
(5) The graph of h is obtained when g is translated 45° to the right. Write down the equations of the asymptotes of h in the interval $x \in [-180^\circ; 180^\circ]$.

(2)

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(b) In the diagram below. Points B, C and D are on the same horizontal plane. AD is perpendicular to the horizontal.

$AD = h$, $AC = 2h$, the angle of depression of B from A is 30° and angle $BAC = 2x$.



(1) Determine the length of AB in terms of h .

(2)

(2) Show that $BC = h\sqrt{25 - 24\cos^2 x}$.

(4)
[15]

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(4) Prove that PT is a tangent to the circle through points P, O and A.

(5) Show that $\hat{OAP} = 90^\circ$.

(2)

(4)

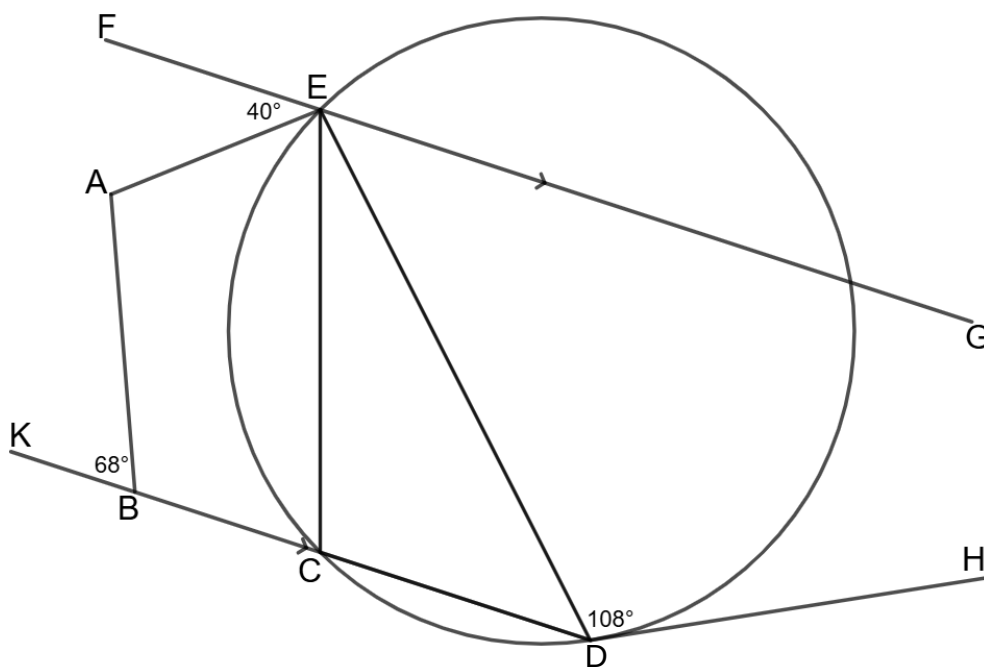
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(b) In the diagram below, E, C and D are points on the circle.

DH is a tangent to the circle at point D with $\angle HDE = 108^\circ$.

DC is produced and $DCBK \parallel GEF$

A is a point between the parallel lines with $\angle FEA = 40^\circ$ and $\angle ABK = 68^\circ$.



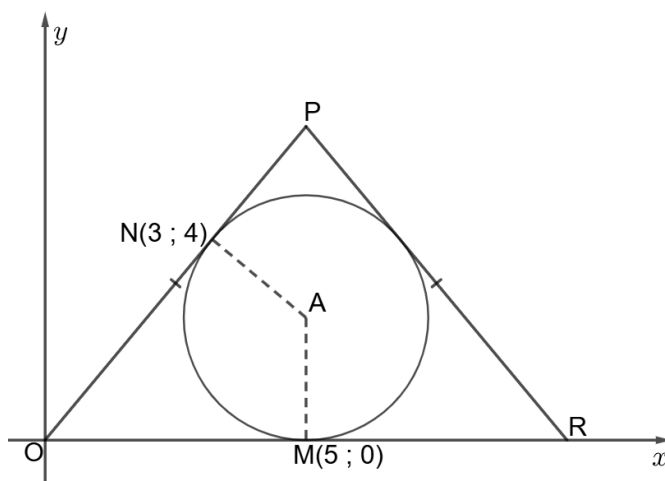
Prove that ABCE is a cyclic quadrilateral.

(7)
[20]

PLEASE TURN OVER

QUESTION 9

In the diagram below the circle centre is inscribe in the isosceles triangle OPR with $AP = PR$. OP is a tangent at $N(3;4)$ and $M(5;0)$ is the point of tangency of OR with the circle.



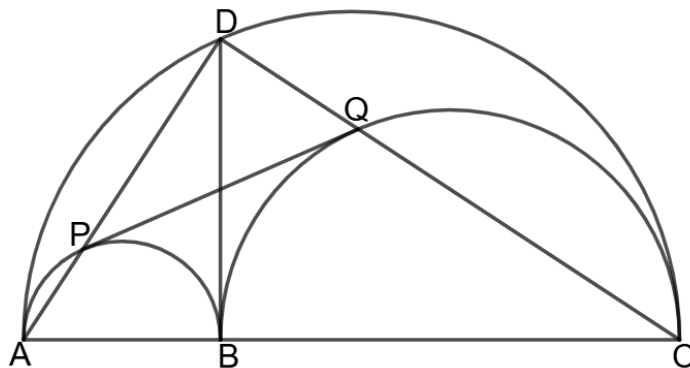
Determine the coordinates of A

[7]

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QUESTION 10

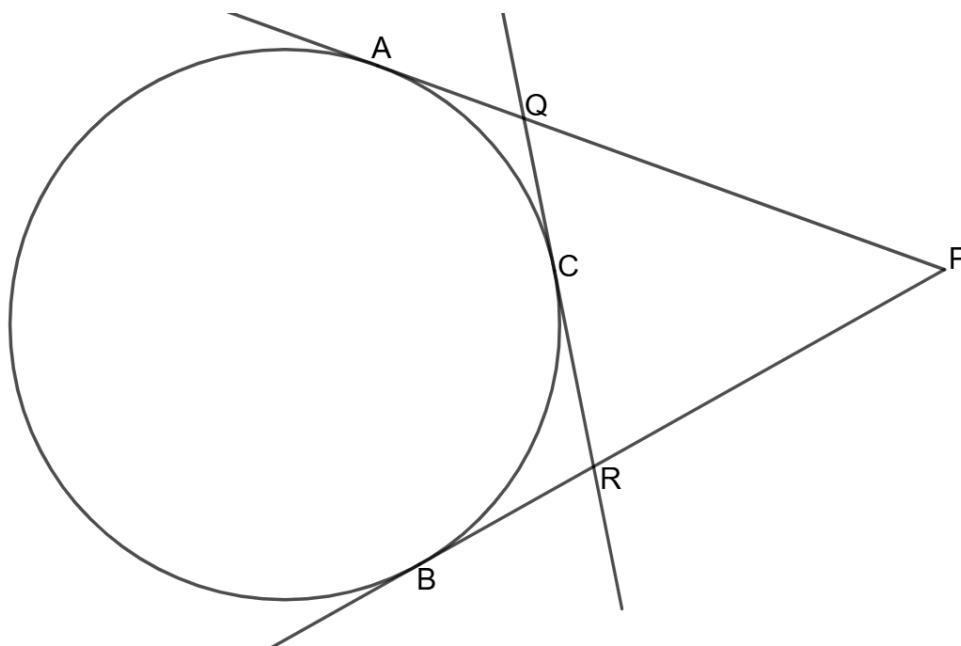
- (a) In the diagram below, three semicircles which are mutually tangent and have their diameters on the line AC . DB is perpendicular to AC , with DA and DC intersecting the two smaller circles at P and Q respectively. If $DB = 10$ units, determine the length of PQ .



(5)

PLEASE TURN OVER

(b) In the diagram below: PA, PB and QR are tangents to the circle at A, B and C respectively.



If $PA = 25$ cm, determine the perimeter of $\triangle PQR$

(7)
[12]

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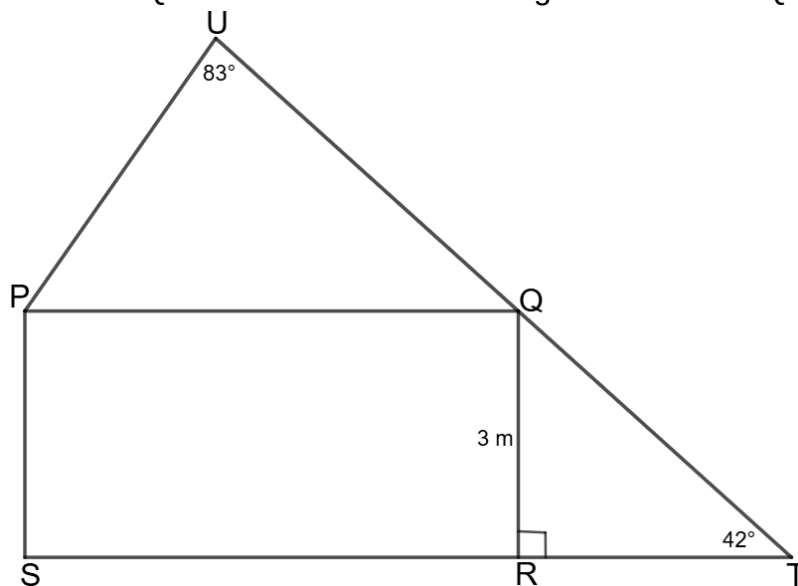
QUESTION 11

(a) The diagram below show the front drawing of the house map.

PQRS is a rectangle with $PQ = 2QR$. TQU is a straight line.

$\hat{P}UQ = 83^\circ$ and $\hat{T} = 42^\circ$.

Give that $QR = 3$ m. Determine the high of U above PQ.



(4)

PLEASE TURN OVER

(b) Given $\sin 76^\circ = x$ and $\cos 76^\circ = y$, show that $x^2 - y^2 = \sin 62^\circ$.

(4)

[8]

Section B: **75 marks**

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