

Grade 12
Analytical Geometry

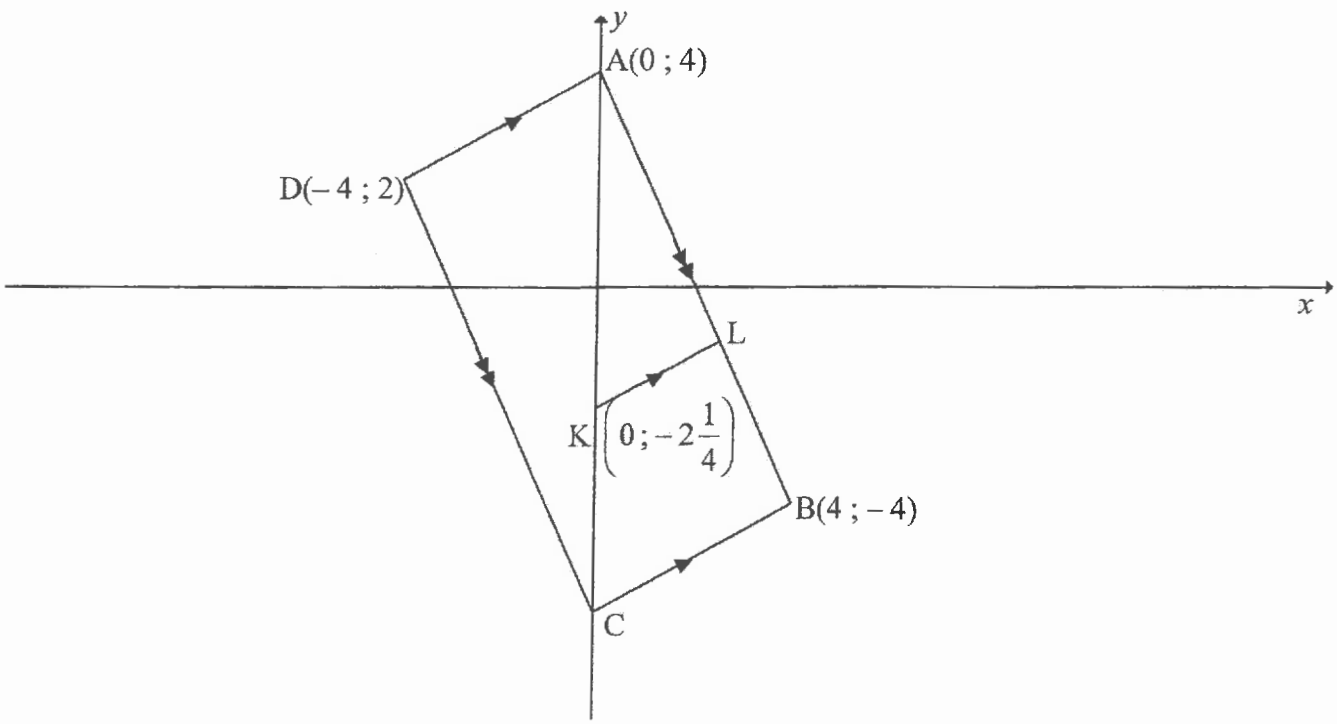
2025 Trial Papers

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QUESTION 3

In the diagram, C is a point on the y-axis such that A(0 ; 4), B(4 ; – 4), C and D(– 4 ; 2) are vertices of parallelogram ABCD. K is the point $\left(0;-2\frac{1}{4}\right)$ and L is a point on AB such that KL | | CB.



3.1 Calculate the length of diagonal DB. (3)

3.2 Calculate the coordinates of M, the midpoint of DB. (3)

3.3 Calculate the gradient of AD. (3)

3.4 Prove that AD ⊥ AB. (3)

3.5 Give a reason why parallelogram ABCD is a rectangle. (1)

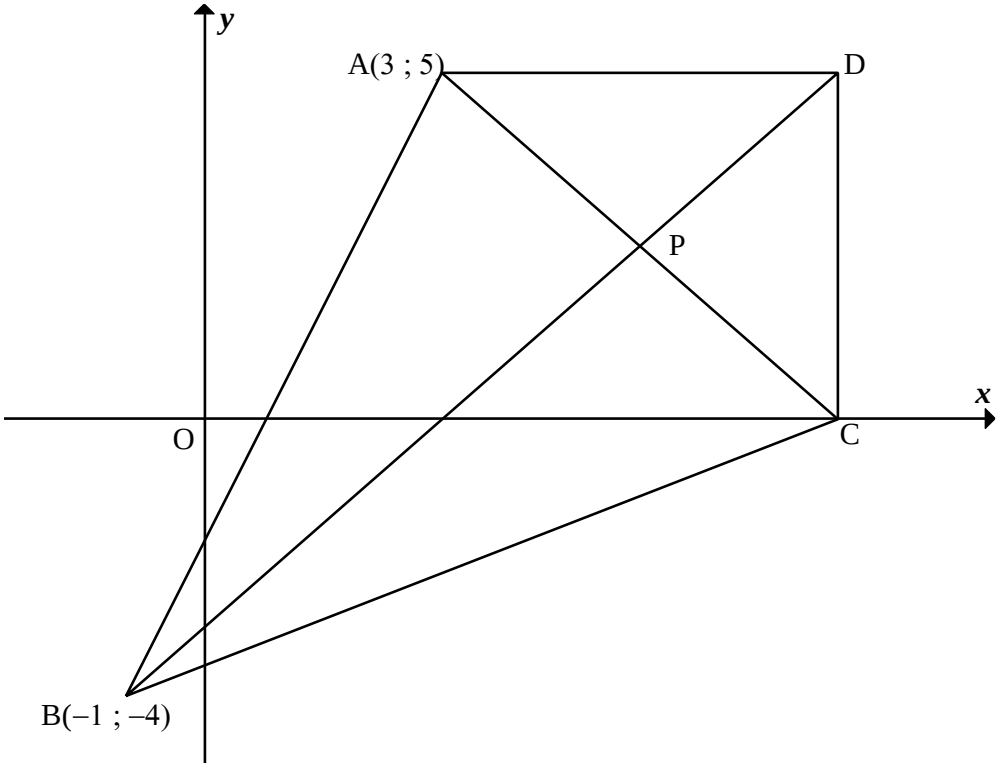
3.6 Determine the equation of KL in the form $y = mx + c$. (2)

3.7 Write down, with reasons, the coordinates of C. (3)
[18]

QUESTION 3

3.1 Show that a triangle ABC, with vertices A(1 ; 1); B(3 ; 6) and C(6 ; 3), is an isosceles triangle. (4)

3.2 In the diagram below, ADCB is a kite with A(3 ; 5) and B(–1 ; –4). AD = DC and AB = BC. D is a point such that AD is parallel to the *x*-axis and AD = 5 units. CD is perpendicular to the *x*-axis. The diagonals intersect at P.



3.2.1 Show that the coordinates of C are (8 ; 0). (2)

3.2.2 Write down the coordinates of point P. (2)

3.2.3 Calculate the gradient of line BD. (2)

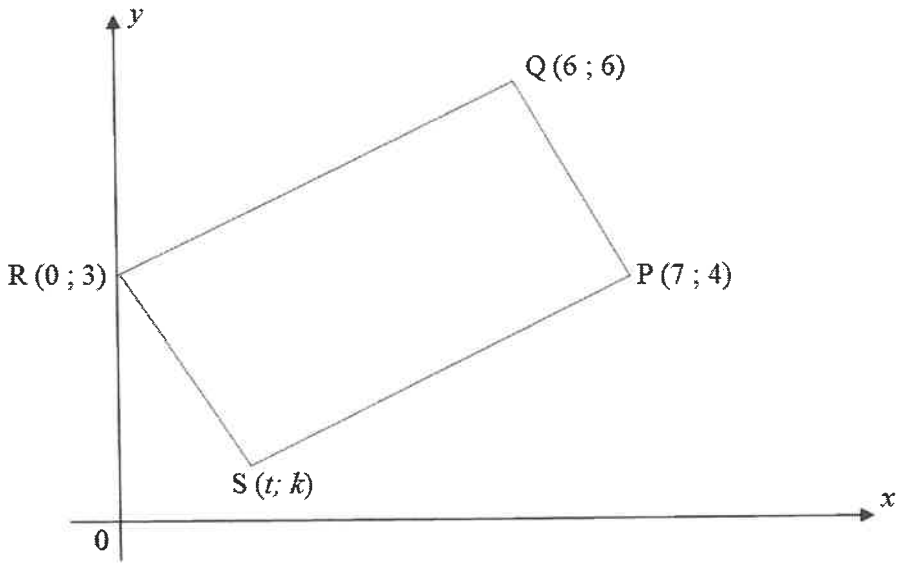
3.2.4 Calculate the length of line AC. (2)

3.2.5 Calculate the area of the kite ADCB. (3)

[15]

QUESTION 3

In the diagram below, P(7 ; 4), Q(6 ; 6), R(0 ; 3) and S(t ; k) are the vertices of quadrilateral PQRS.



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

3.2 If $T\left(\frac{7}{2};\frac{7}{2}\right)$ is the midpoint of QS, determine the coordinates of S. (3)

3.3 If the coordinates of S are (1 ; 1), show that $PR = QS$. (2)

3.4 Show that $QR \perp RS$. (4)

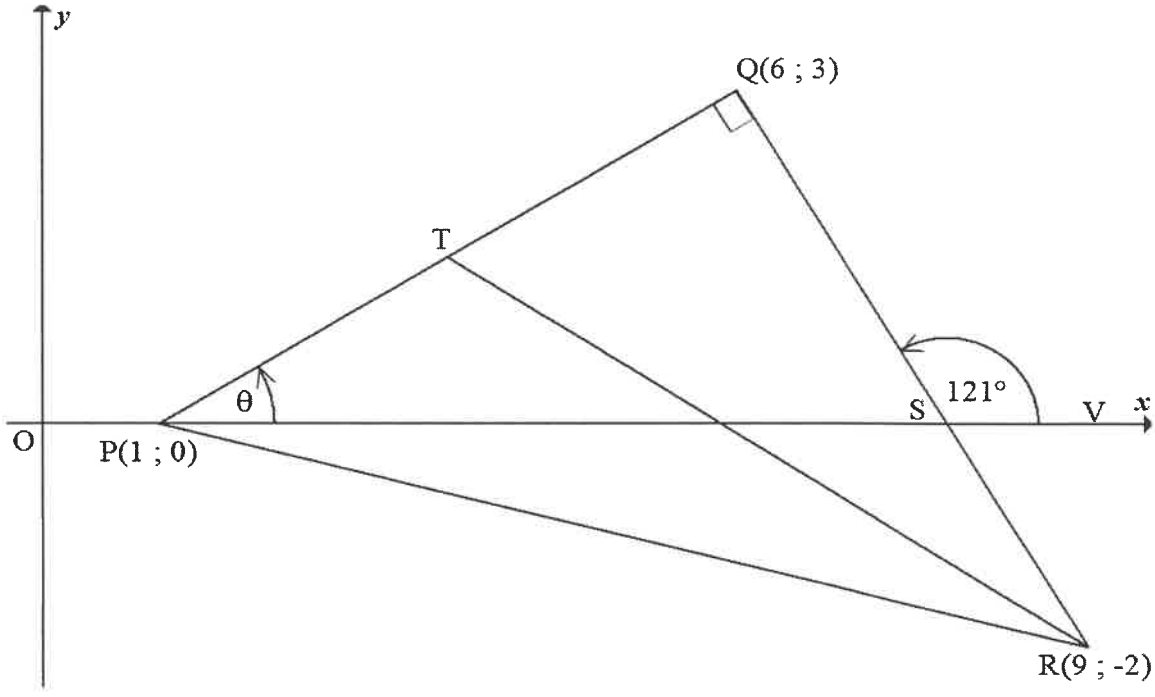
3.5 Hence, what type of special quadrilateral is PQRS? Motivate your answer. (2)

3.6 Calculate the size of $R\hat{S}Q$. (3)

[16]

QUESTION 2

In the diagram below, P(1 ; 0), Q(6 ; 3) and R (9; –2) are the vertices of a triangle such that PQ = QR and PQ ⊥ QR. T is a point on PQ such that T is the midpoint of PQ. S is the point of intersection of RQ and the x-axis. V is a point on the x-axis such that $Q\hat{S}V = 121°$. $Q\hat{P}S = \theta$



2.1 Determine the:

2.1.1 Length of PQ. Leave your answer in surd form. (2)

2.1.2 Gradient of PQ (2)

2.1.3 Coordinates of T (2)

2.2 Calculate the:

2.2.1 Area of ΔQTR (3)

2.2.2 Size of θ, with reasons (2)

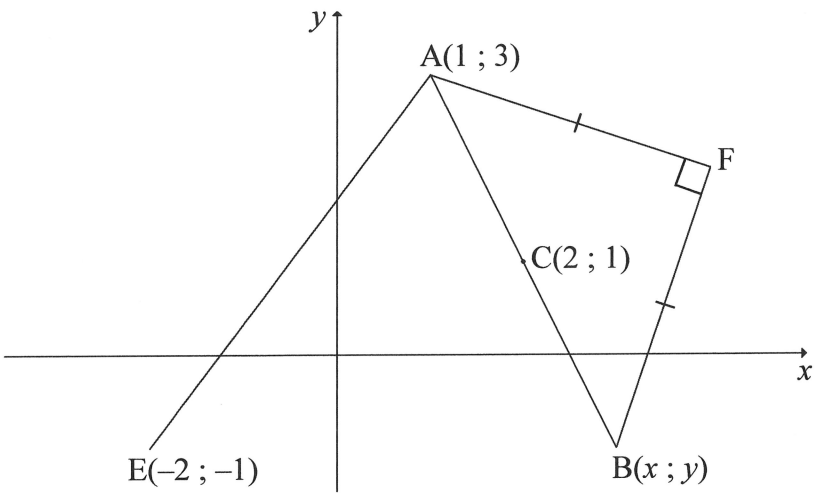
2.2.3 Coordinates of S (3)

2.3 Determine, with reasons, the gradient of the line through T and the midpoint of PR. (3)
[17]

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QUESTION 2

In the diagram below, A(1 ; 3), B(x ; y) and E(–2 ; –1) are points on a Cartesian plane. C(2 ; 1) is the midpoint of AB. Also, F is a point such that AF = FB and AF ⊥ FB.



2.1 Determine the:

2.1.1 Length of AE (2)

2.1.2 Gradient of AC (2)

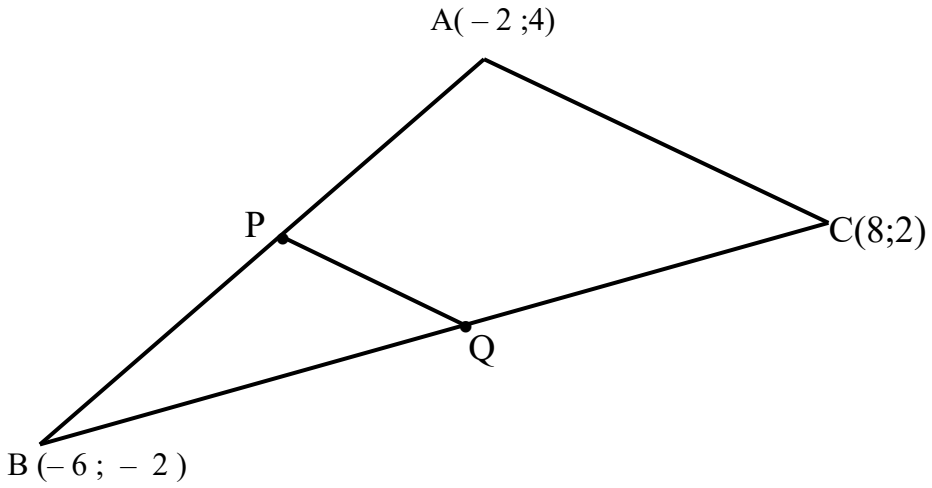
2.1.3 Coordinates of B (3)

2.2 BE is joined to form a special quadrilateral AFBE. Name the special quadrilateral AFBE. Give full justification for your answer. (3)

2.3 Calculate the area of ΔAFB. (5)
[15]

QUESTION 2

In the diagram below, the coordinates of ΔABC are given as A(– 2 ; 4) , B(– 6 ; – 2) and C(8 ; 2). P and Q are the midpoints of AB and BC respectively.



2.1 Calculate the coordinates of P and Q. (4)

2.2 Show that:

2.2.1 PQ // AC (4)

2.2.2 $PQ = \frac{1}{2}\ AC$ (4)

2.3 Calculate, to two decimal places, the perimeter of Δ ABC. (4)

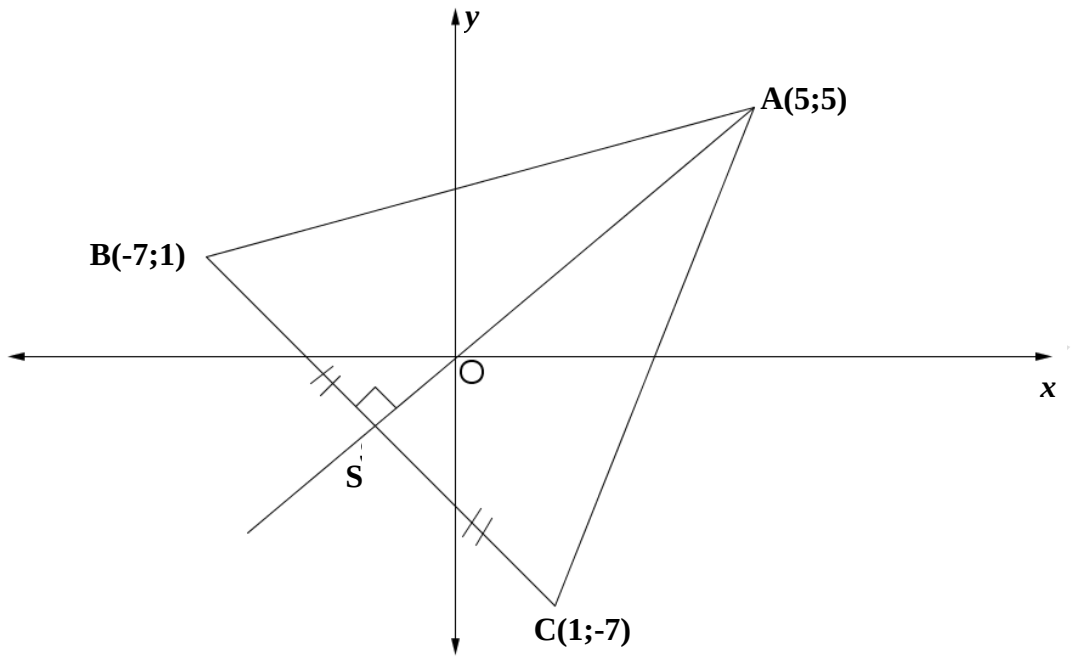
[16]

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QUESTION 3

In the Cartesian Plane below, points **A**(5; 5), **B**(–7; 1) and **C**(1; –7) are the vertices of a triangle.

Point **S** is the midpoint of **BC**. The line **AS** is perpendicular to **BC**.



3.1 Determine the coordinates of point **S**. (3)

3.2 Determine the gradient of the line **AC**. (2)

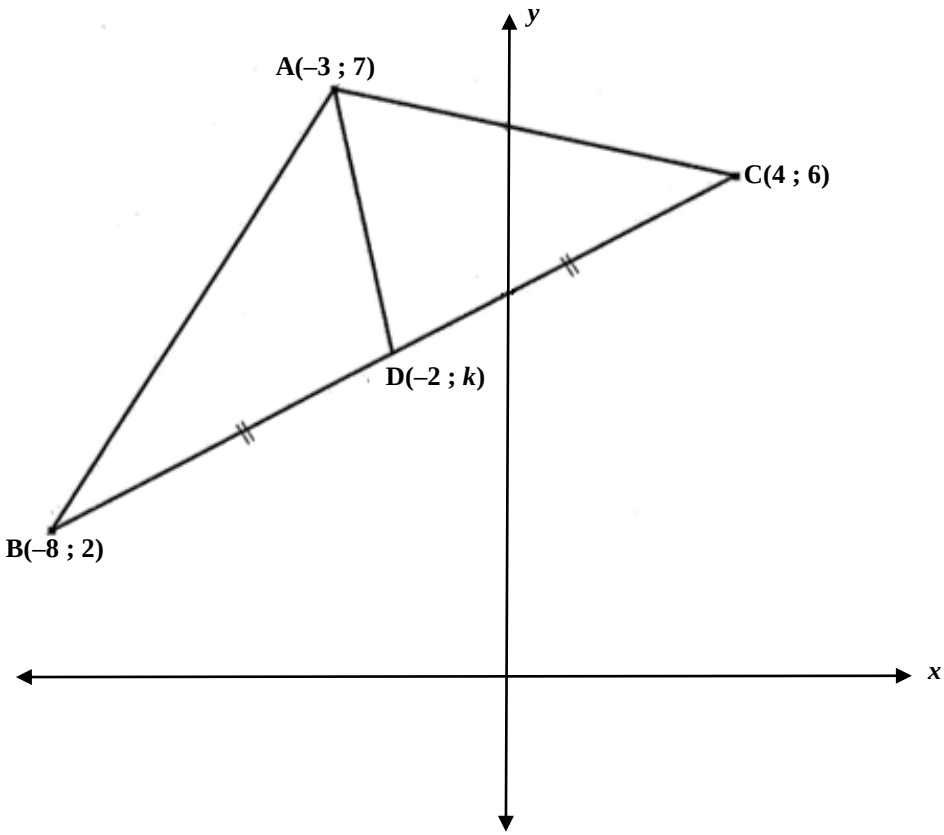
3.3 Determine the distance of **BC**. (3)

3.4 Determine the area of ΔABC. (5)

[13]

QUESTION 3

In the diagram below A (–3;7), B (–8;2) and C (4;6) are the vertices of triangle ABC.
AD is drawn such that D (–2;k) is the midpoint of BC.



3.1 Determine the gradient of BC. (2)

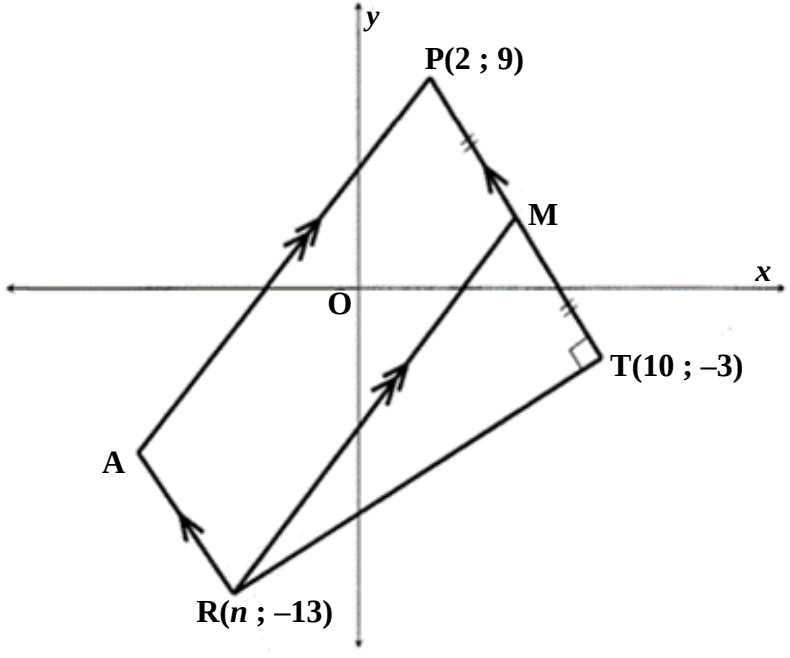
3.2 Calculate the length of BC. (2)

3.3 Determine the value of k. (2)

3.4 Is AD ⊥ BC? Show all your calculations. (3)
[9]

QUESTION 3

In the diagram below, P (2;9), A, R(n ; –13) and M are vertices of parallelogram PARM. PMT is a straight line such that M is the midpoint of PT.
T (10; –3) is a point such that PT ⊥ RT.



3.1 Determine:

3.1.1 The length of PT (Leave your answer in surd form.) (2)

3.1.2 The gradient of PT (2)

3.1.3 The gradient of AR (1)

3.1.4 The coordinates of M (3)

3.2 Determine the equation of PM in the form $y = mx + c$. (3)

3.3 Show that $n = 5$. (3)

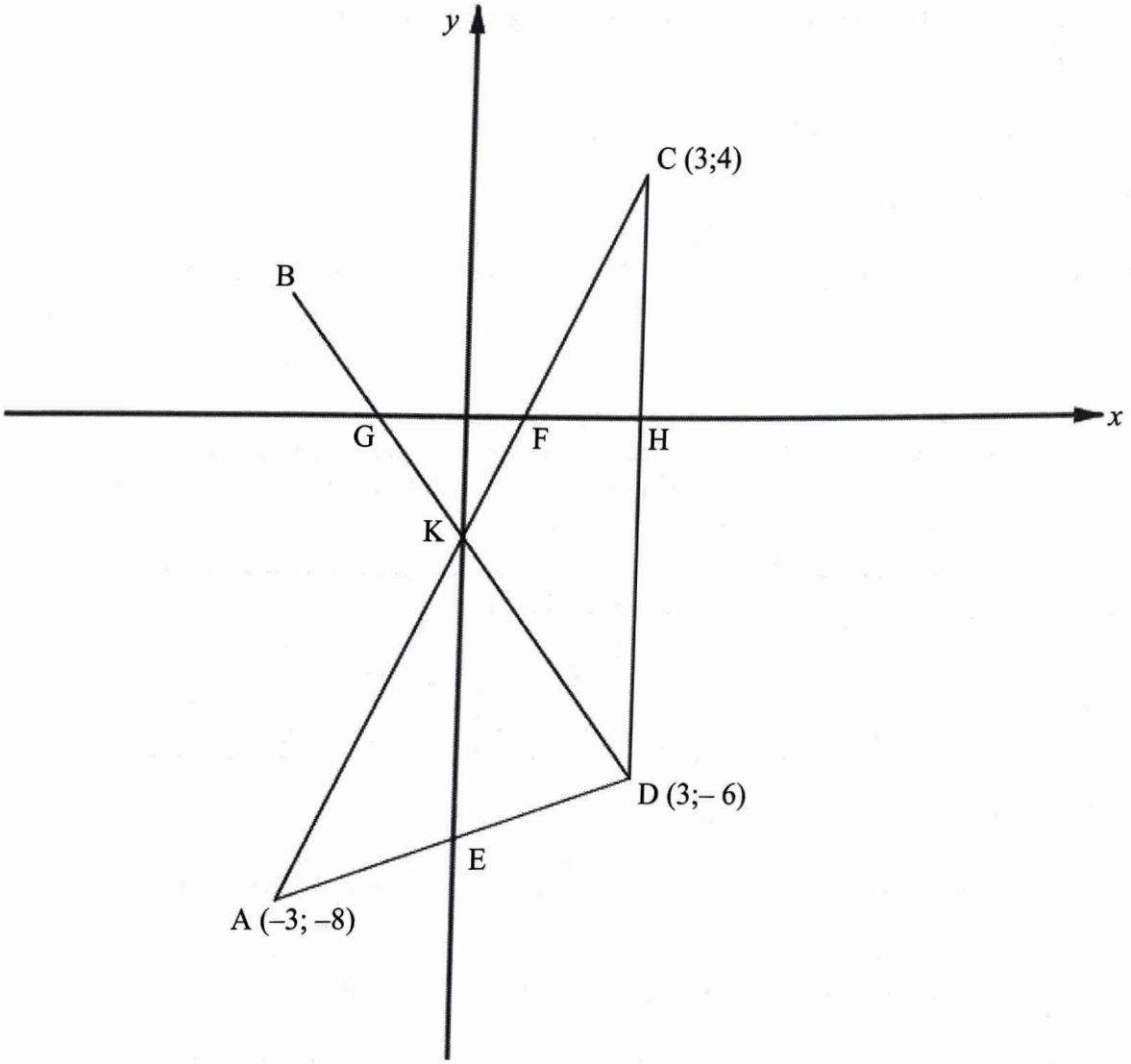
3.4 Calculate the area of ΔRMT. (4)

[18]

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 $y = ...$ (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)

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3.6 Write down the equation of CD. (1)

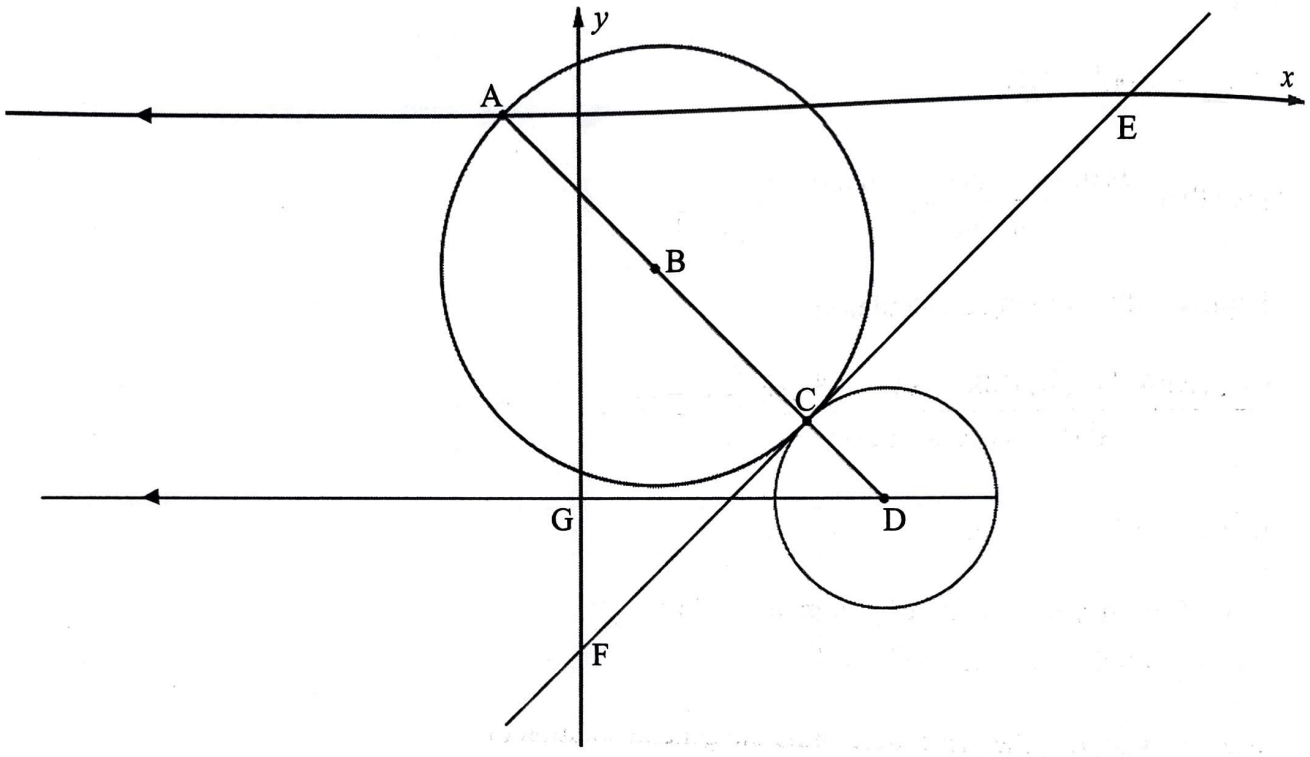
3.7 **Determine** the numerical value of $\frac{\text{Area of } \Delta CKD}{\text{Area of } EKCD}$ (5)

[23]

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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)

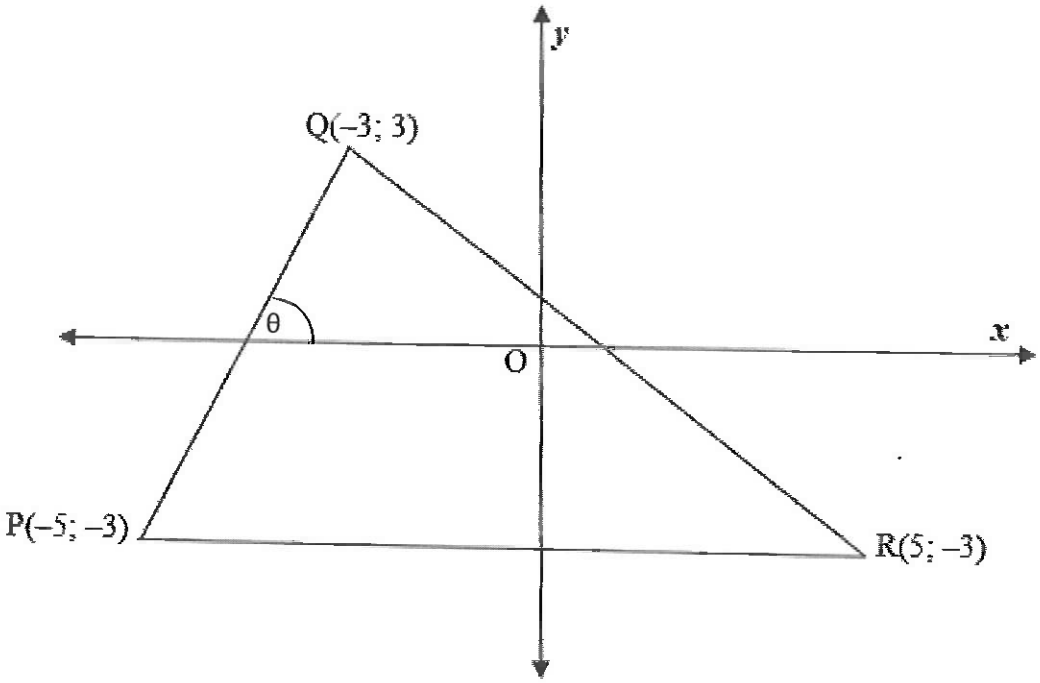
4.5 Determine the coordinates of D. (4)

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

[19]

QUESTION 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)

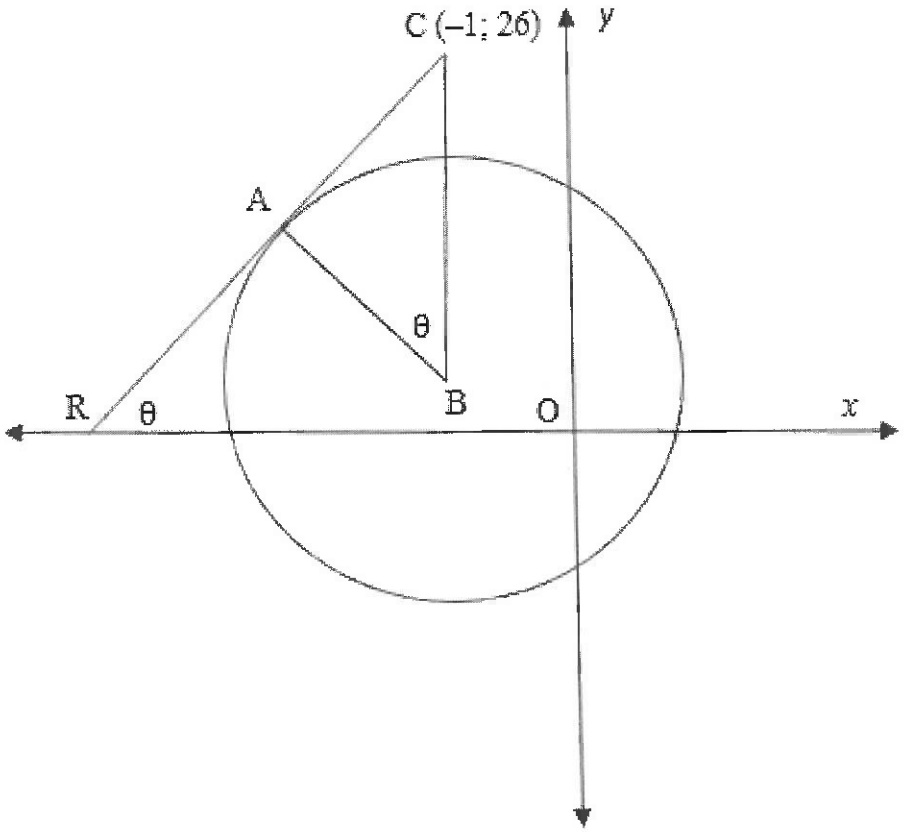
3.6 Determine the coordinates of S, if PQRS is a parallelogram, with S in the first quadrant. (2)

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)

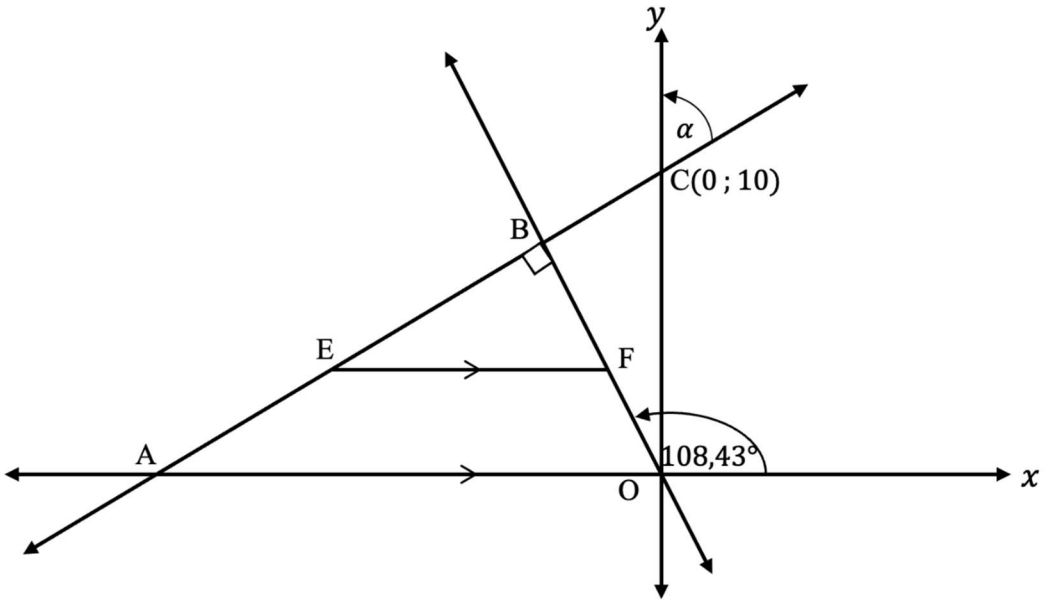
4.4 The equation of the radius AB. (4)

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

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QUESTION 3

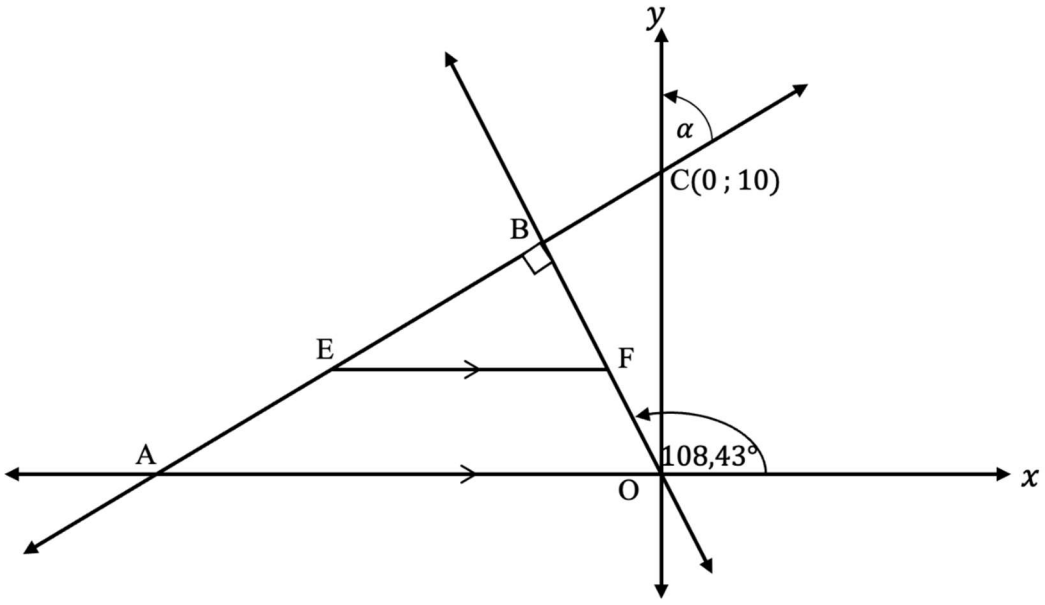
In the diagram, ΔABO is drawn. E is the midpoint of AB which is produced to C. A is the *x*-intercept and C(0 ; 10) is the *y*-intercept of AC. Line EF is drawn parallel to the *x*-axis. AB⊥OB and the angle of inclination of OB is $108,43^{\circ}$. The angle formed by AC and the *y*-axis is α.



3.1	Determine the gradient of line OB.	(2)
3.2	Determine the equation of line AB in the form $y = mx + c$.	(2)

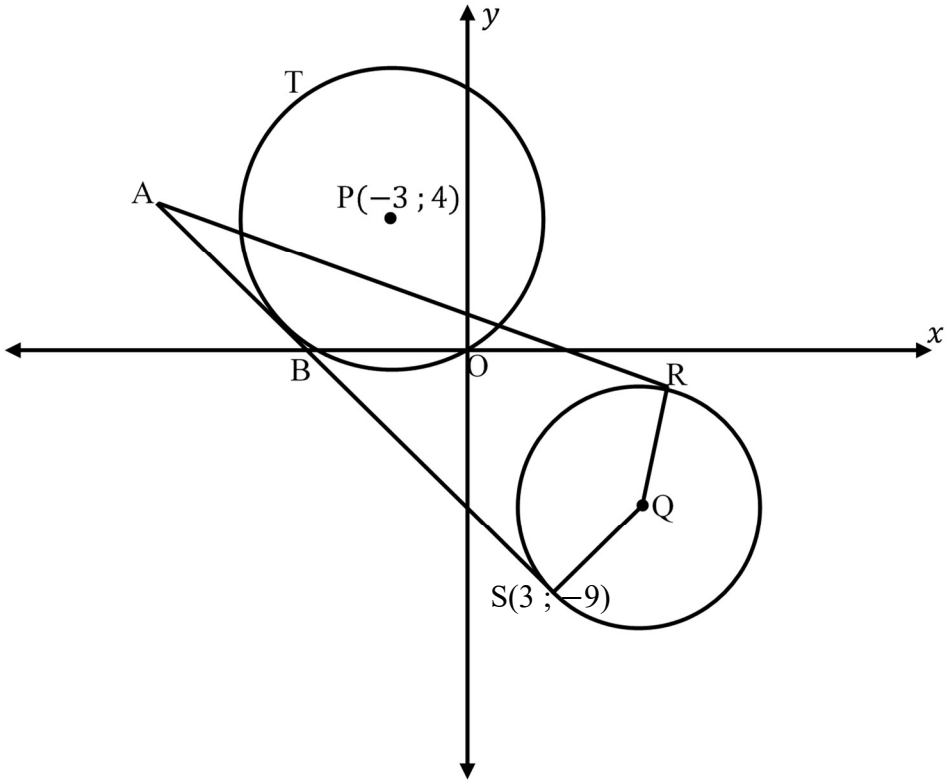
3.3	Calculate the coordinates of B.	(3)
3.4	Calculate the length of BF.	(4)

3.5	Calculate the area of ΔCBO.	(4)
3.6	Determine the size of α.	(3)
		[18]



QUESTION 4

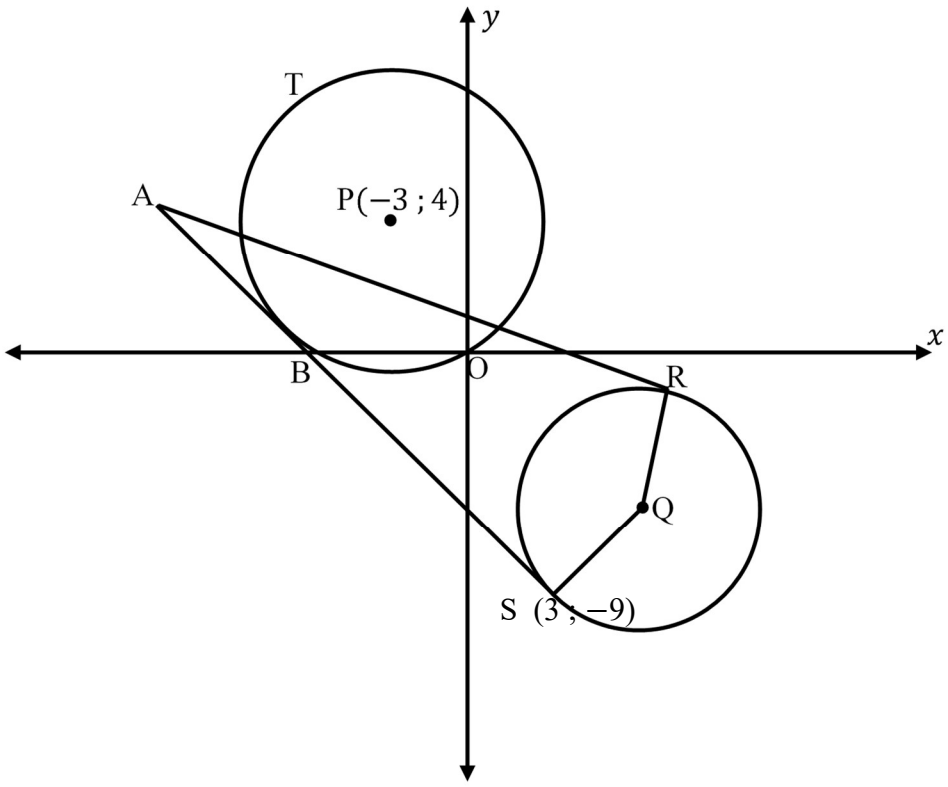
In the diagram, P$(-3\,;4)$ is the centre of the circle passing through points B, T and the origin. A second circle is drawn, with centre Q and equation $x^2 - 12x + y^2 + 12y + 54 = 0$. Points R and S$(3\,;-9)$ lie on the circle. AS and AR are both tangents to the circle with centre Q. B is the *x*-intercept of AS.



4.1	Determine the equation of the circle with centre P.	(3)
4.2	OT is the diameter of the circle with centre P. Determine the coordinates of T.	(3)

4.3	Calculate the coordinates of Q.	(3)
4.4	Determine the equation of AS in the form $y = mx + c$.	(5)
4.5	Identify the type of quadrilateral that ASQR is and substantiate your answer.	(2)

4.6	Determine the scale factor k by which the radius of the circle with centre Q should be increased such that the two circles touch once.	
		(4)
		[20]



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QUESTION 3

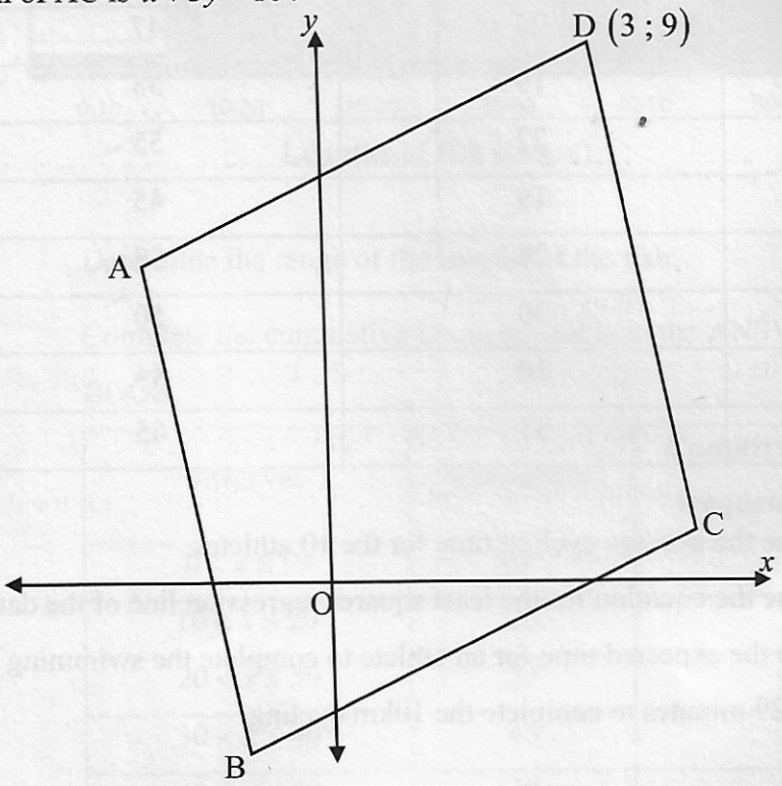
3.1 P(–3 ; 2) and Q(5 ; 8) are two points in a Cartesian plane.

3.1.1 Calculate the length of PQ. (2)

3.1.2 Calculate the angle that PQ forms with the $x-$axis, rounded of the nearest integer. (3)

3.1.3 Determine the equation of the perpendicular bisector of PQ in the form $y = ...$ (5)

3.2 In the diagram A, B, C and D$(3 ; 9)$ are the vertices of a rhombus. The equation of AC is $x + 3y = 10$.



3.2.1 Determine the equation of BD. (3)

3.2.2 Calculate the coordinates of K if the diagonals of the rhombus intersect at point K. (4)

3.2.3 Determine the coordinates of B. (2)

3.2.4 Calculate the coordinates of A and C if AD $= 5\sqrt{2}$ units. (7)

3.2.5 If the rhombus is reflected about the line $x = 1$, find the coordinates of the image of A. (2)

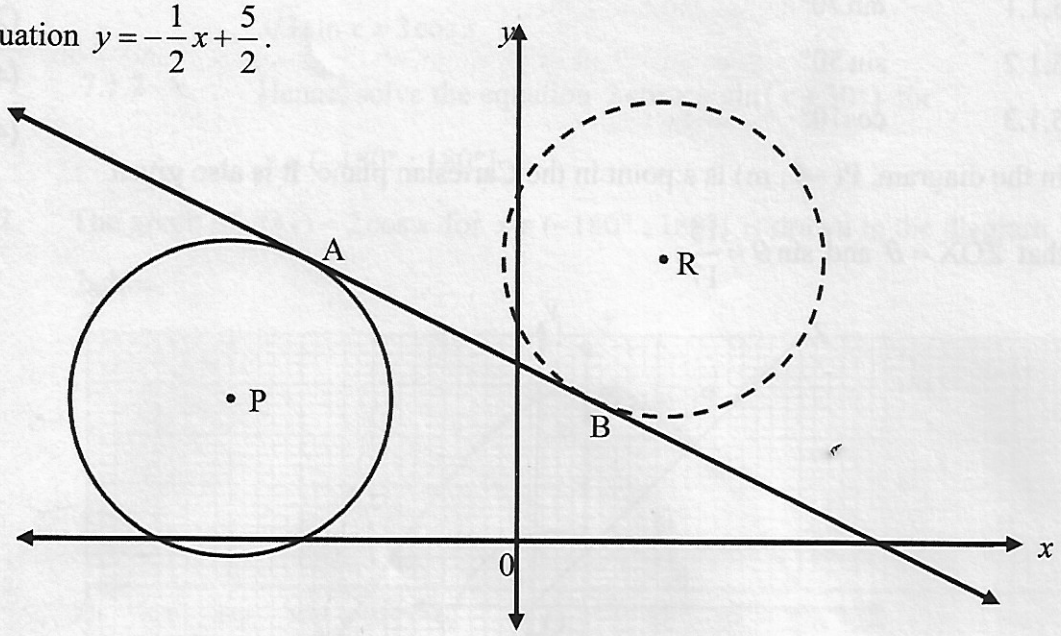
[28]

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QUESTION 4

The diagram shows a circle with centre P $(-4\ ;\ 2)$ and a tangent at A $(a\ ;\ b)$ with equation $y=-\frac{1}{2}x+\frac{5}{2}$.



4.1 Determine the coordinates of A. (5)

4.2 Determine the equation of the circle P in the form $(x-a)^2+(y-b)^2=r^2$. (3)

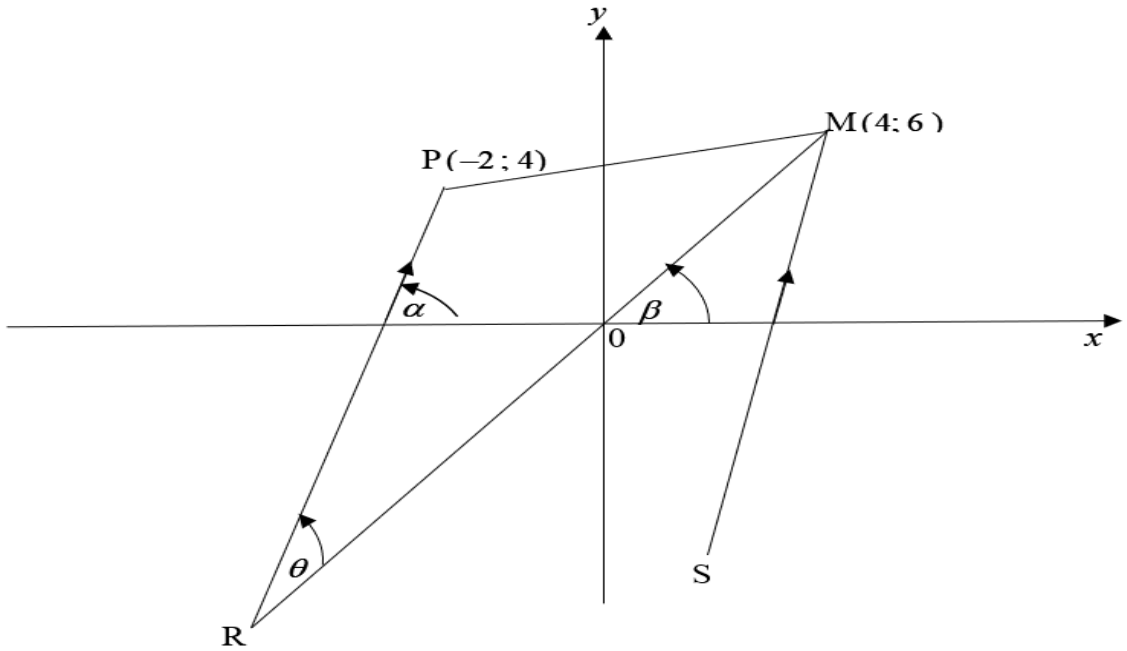
4.3 It is further given that the circle P is reflected about the line AB and then translated along the line AB to centre R . Circle R has $y-$intercepts at 3 and 5. Find the coordinates of R. (4)

[12]

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QUESTION 3

In the diagram below, ΔPMR is drawn with vertices $P(-2;4), M(4;6)$ and R in the Cartesian plane. Line MR passes through the origin at O. $P\hat{R}M = \theta$ and PR||MS.The equation of MS is given by $y - 5x + 14 = 0$.



3.1 Calculate the length of MR, in simplified surd form. (2)

3.2 Determine the equation of MR (3)

3.3 Determine the equation of PR. (3)

3.4 Determine the coordinates of R. (3)

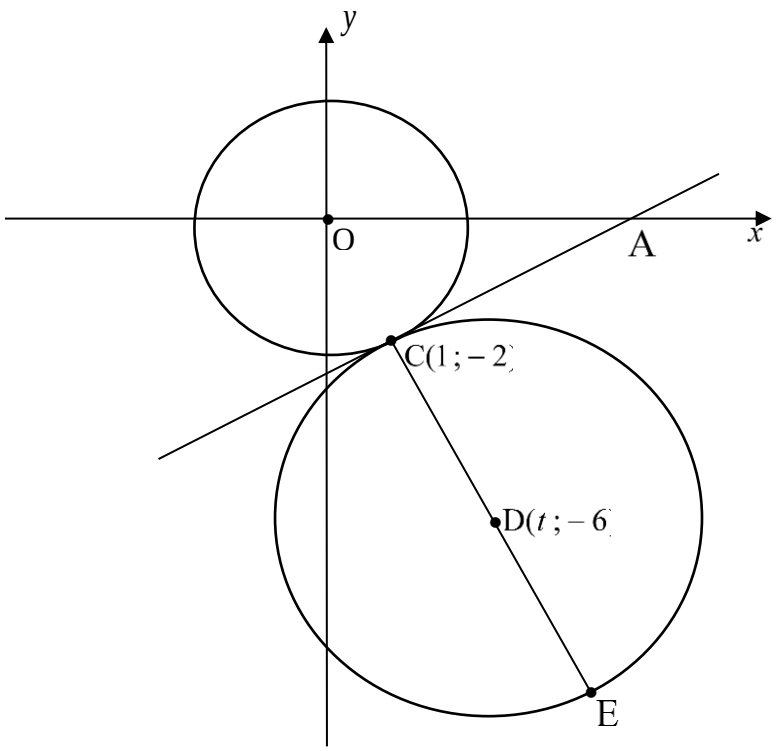
3.5 Calculate the size of θ , rounded off to TWO decimal places. (4)

3.6 Calculate the area of PMSR if it is further given that PMSR is a parallelogram. (4)

[19]

QUESTION 4

The diagram below consists of two circles, which touch each other externally at C (1; –2).
The smaller circle has its centre O at the origin. The other circle has centre D(t ; – 6) .CA is a common tangent which intersects the x-axis at A. CDE is the diameter of the larger circle.



4.1 Give a reason why the points O, C and D lie on a straight line. . (2)

4.2 Calculate the gradient of OC (2)

4.3 Hence, show that the value of $t = 3$. (2)

4.4 Determine the equation of the tangent AC in the form $y = mx + c$. (3)

4.5 Calculate the coordinates of E. (2)

4.6 Determine the equation of a circle passing through the points A (5 ; 0), C and E in the form $(x-a)^2 + (y-b)^2 = r^2$. (5)

4.7 If a circle with centre D and equation $(x-3)^2 + (y+6)^2 = r^2$ has to cut the circle with centre O twice, give all possible values of *r*. (4)

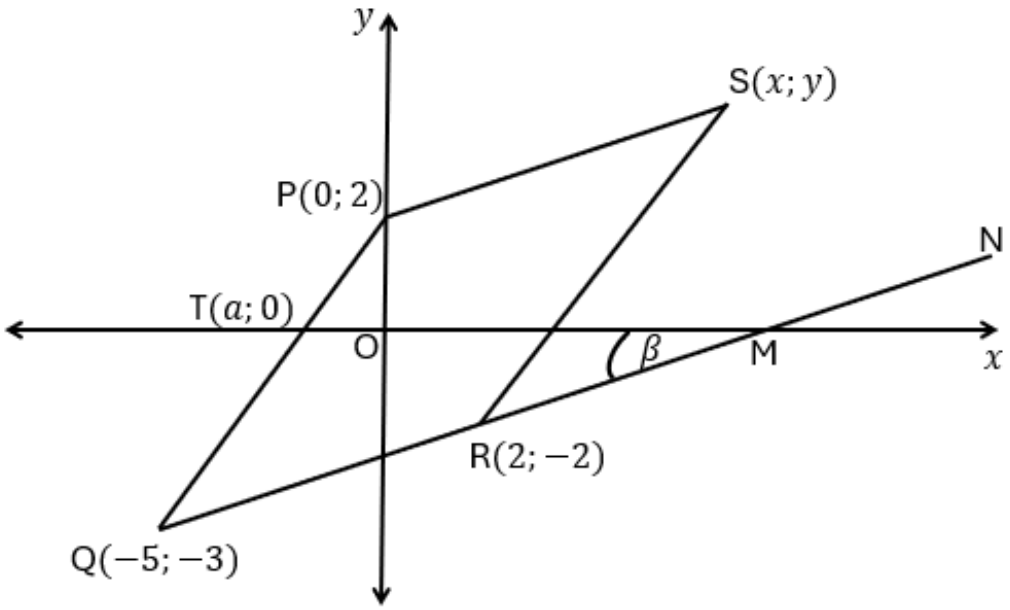
[20]

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QUESTION 3

In the diagram below, P$(0; 2)$, Q$(-5; -3)$, R$(2; -2)$ and S$(x; y)$ are vertices of a parallelogram PQRS. The $x-$ intercept of PQ is T$(a; 0)$. QN cuts the $x-$ axis at M. $T\widehat{M}Q = \beta$



3.1 Determine the gradient of QR. (2)

3.2 Calculate the size of β. (3)

3.3 Determine the value of a. (4)

3.4 Determine the coordinates of S. (2)

3.5 Show that the diagonals of PQRS bisect each other. (3)

3.6 Show that ΔPQR is an isosceles triangle. (3)

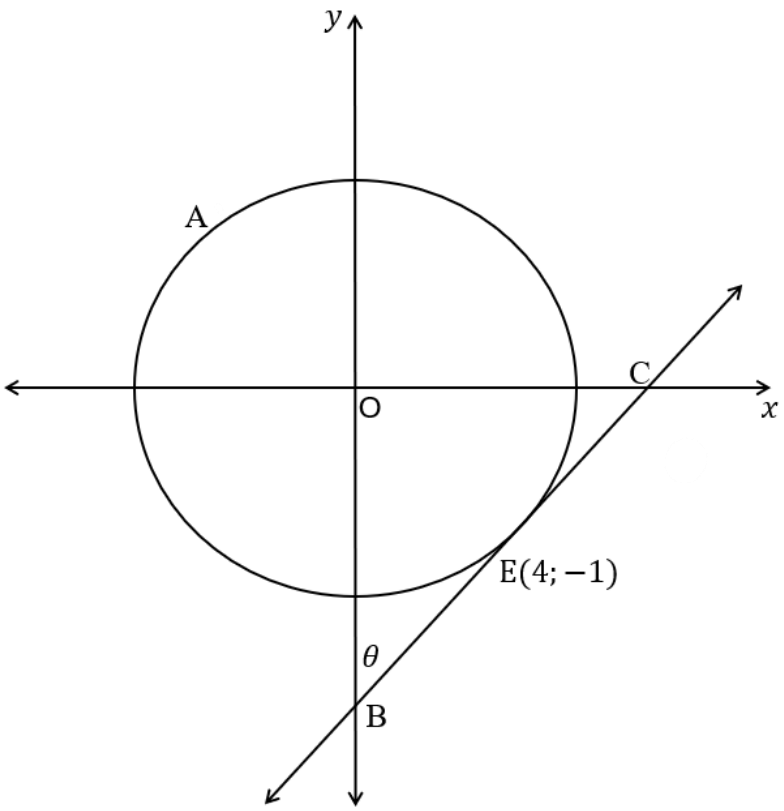
3.7 PSRQ is a parallelogram, but which other type of quadrilateral is it? Give a reason for your answer. (2)

3.8 Calculate the size of $\hat{Q}$. (3)

[22]

QUESTION 4

In the diagram, a circle with centre O passes through the point A. The tangent to the circle at E$(4;-1)$ cuts the $x-$ and $y-$ axis at C and B respectively. $O\hat{B}C = \theta$



4.1 Determine the equation of the circle. (3)

4.2 O is the midpoint of AE. Determine the coordinates of A. (2)

4.3 Determine the equation of BC in the form $y = mx + c$. (4)

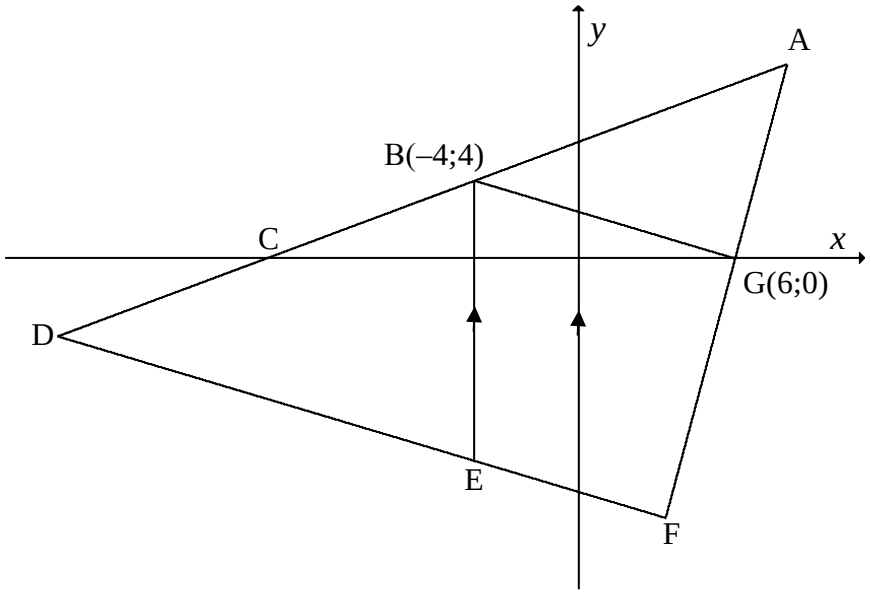
4.4 Determine the equation of the line through the centre of the circle that is parallel to tangent BC. (2)

4.5 The circle with center $S(a;b)$ touches the circle with center O externally at E. BC is a tangent to both circles. If $OS = 3OE$, determine the coordinates of S. (7)

[18]

QUESTION 3

In the diagram A, D and F are the vertices of ΔADF. The equation of AD is $y = \frac{1}{2}x + 6$ and AD cuts the *x*-axis at C. $B(-4\ ;\ 4)$ lies on AD and E lies on DF such that BE is parallel to the *y*-axis. AF cuts the *x*-axis at $G(6\ ;\ 0)$. BG is drawn. The equation of DF is $5y + 2x + 60 = 0$.



3.1 Calculate the gradient of BG. (2)

3.2 Show that BG is parallel to DF. (2)

3.3 Calculate the coordinates of D. (4)

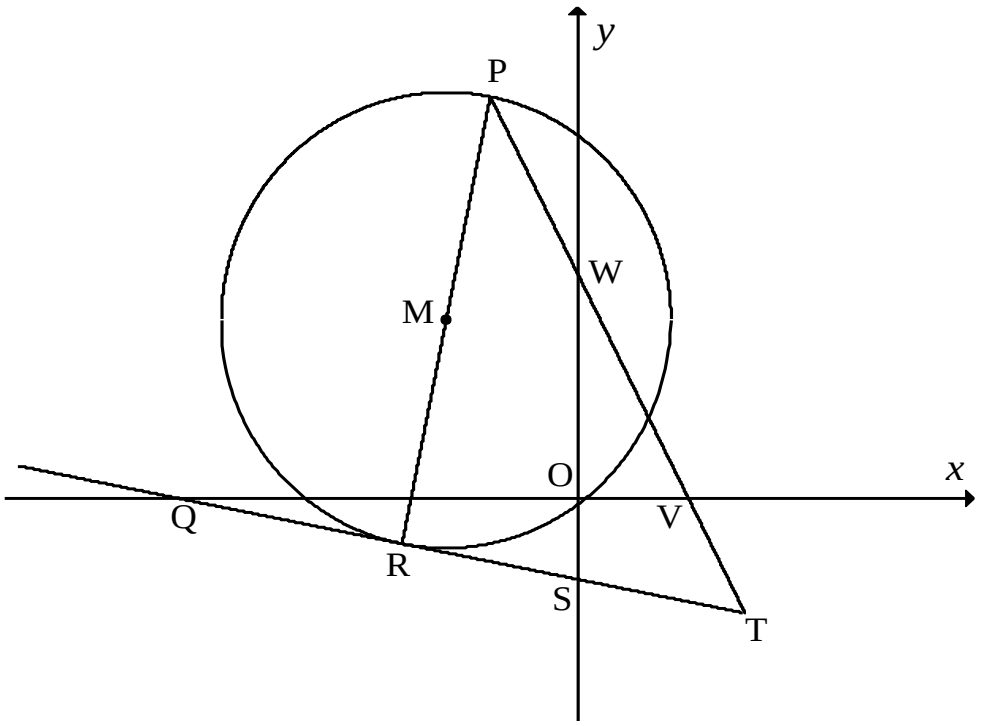
3.4 Calculate the length of BE. (4)

3.5 Let J be a point in the third quadrant such that DJEB, in that order, forms a parallelogram. Calculate the area of DJEB. (4)

[16]

QUESTION 4

4.1 In the diagram, the equation of the circle with centre M is $(x+3)^2+(y-4)^2=26$
PMR is a diameter of the circle. The equation of the tangent QRST to the circle at R is $y=-\frac{1}{5}x+k$. Q and S are respectively the *x*- and *y*-intercepts of QRST.
PWVT is a straight line, with *y*-intercept W and *x*-intercept V.



4.1.1 Write down:

(a) the coordinates of M. (1)

(b) the length of the radius (1)

4.1.2 Determine the equation of the diameter PMR. (3)

4.1.3 Determine the coordinates of R. (6)

4.1.4 Calculate the value of *k*. (2)

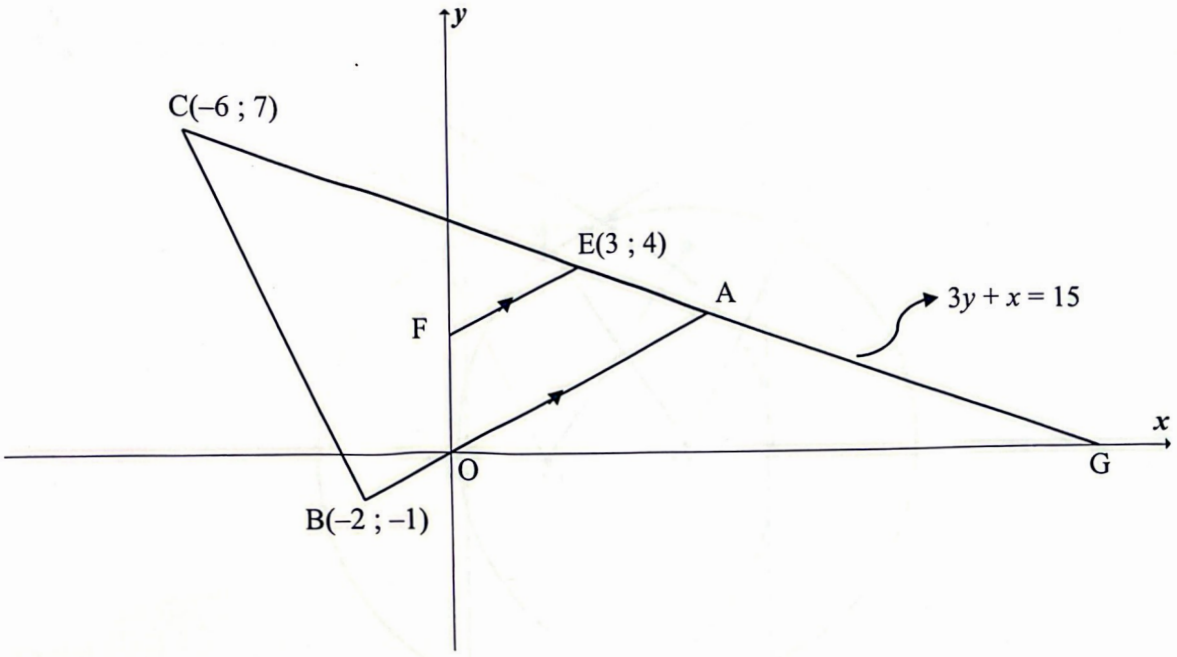
4.1.5 If $O\hat{W}V=11,31°$, prove that WVSQ is a cyclic quadrilateral. (4)

4.2 Prove that the radius of the circle having equation $x^2+y^2+4x\cos\theta+8y\sin\theta+3=0$ can never exceed $\sqrt{13}$ for any value of θ. (5)

[22]

QUESTION 3

In the diagram below, A, B(–2 ; –1) and C(–6 ; 7) are vertices of ΔABC. CA is produced to cut the x-axis at G. F is a point on the y-axis and E(3 ; 4) a point on CA such that FE ∥ BA. Line AB passes through the origin. The equation of CG is $3y + x = 15$.



3.1 Calculate the gradient of AB. (2)

3.2 Prove that CB ⊥ BA. (3)

3.3 Determine the equation of FE in the form $y = mx + c$. (3)

3.4 Calculate the:

3.4.1 Size of $O\hat{F}E$ (3)

3.4.2 Area of quadrilateral OFEG (6)

3.5 A(6 ; 3), B, C and D form a rectangle with point D in the first quadrant.

3.5.1 Calculate the coordinates of D. (2)

3.5.2 A circle is drawn through points A, B and C.

(a) Calculate the coordinates of the centre of the circle. (2)

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

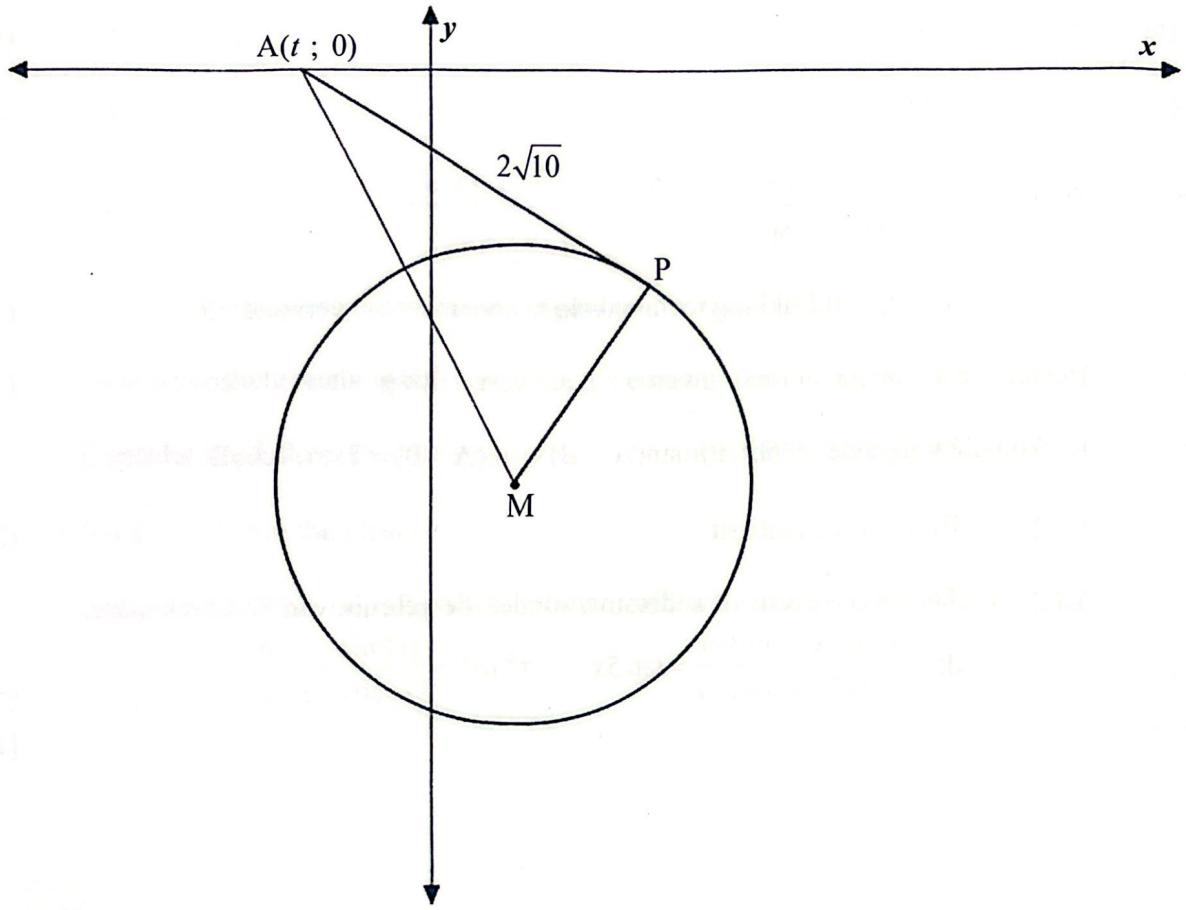
[24]

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QUESTION 4

In the diagram below, a circle, centred at M, with the equation $x^2 - 4x + y^2 + 10y + 19 = 0$, is drawn. From A($t$; 0), a tangent is drawn to touch the circle at P. ΔAPM is drawn and $AP = 2\sqrt{10}$.



4.1 Give a reason why $A\hat{P}M = 90°$. (1)

4.2 Calculate the:

4.2.1 Coordinates of M (3)

4.2.2 Length of PM, the radius of the circle (1)

4.3 Show that $t = -3$. (4)

4.4 Another circle, centred at N, with the equation $(x-5)^2 + (y-e)^2 = 40$, is drawn. Centre N lies on produced line MA, with the equation $y = -x - 3$.

4.4.1 Write down the coordinates of N. (2)

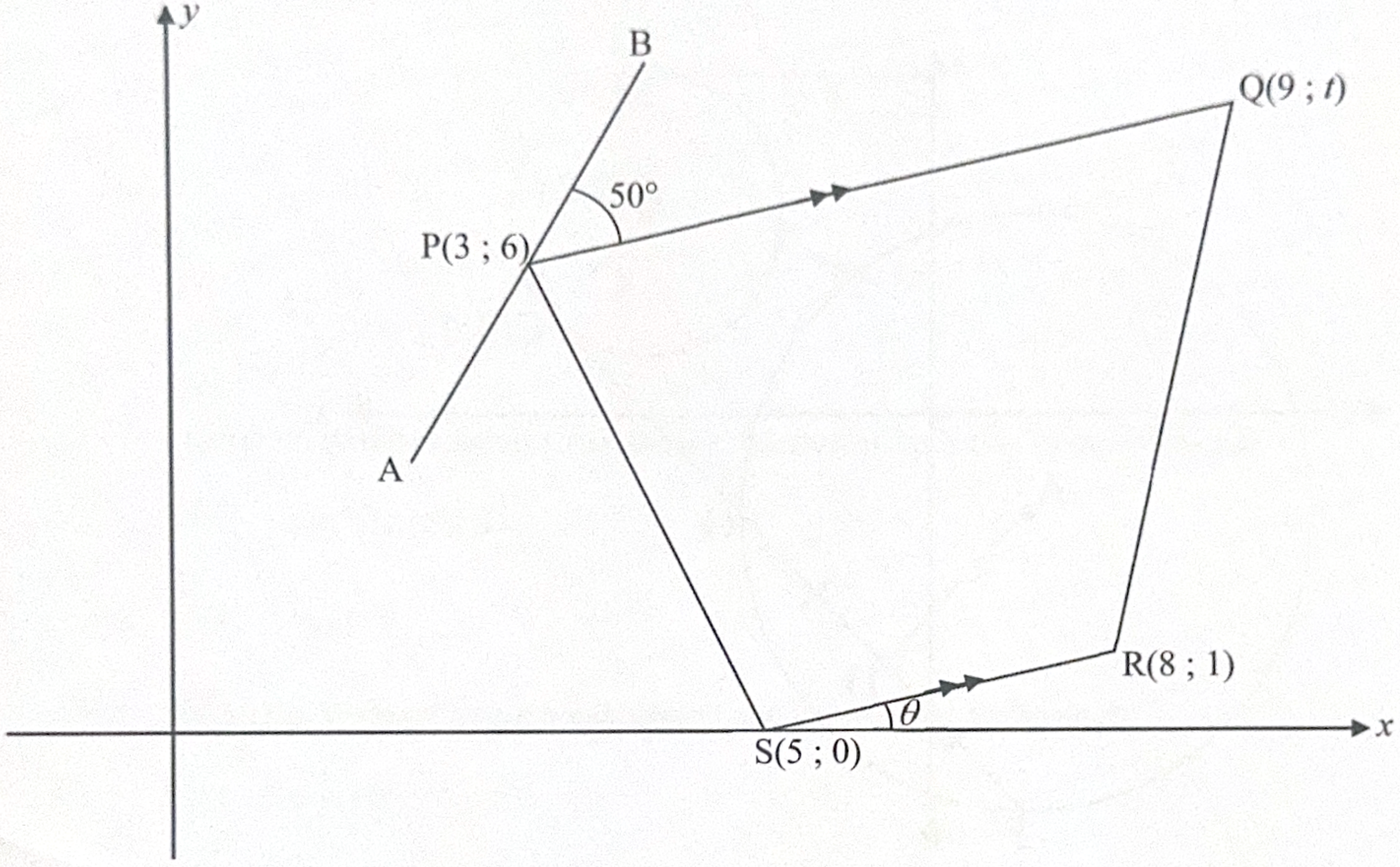
4.4.2 Determine whether the two circles, centred at M and N, will intersect, touch externally, or do not intersect at all. (5)
[16]

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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)

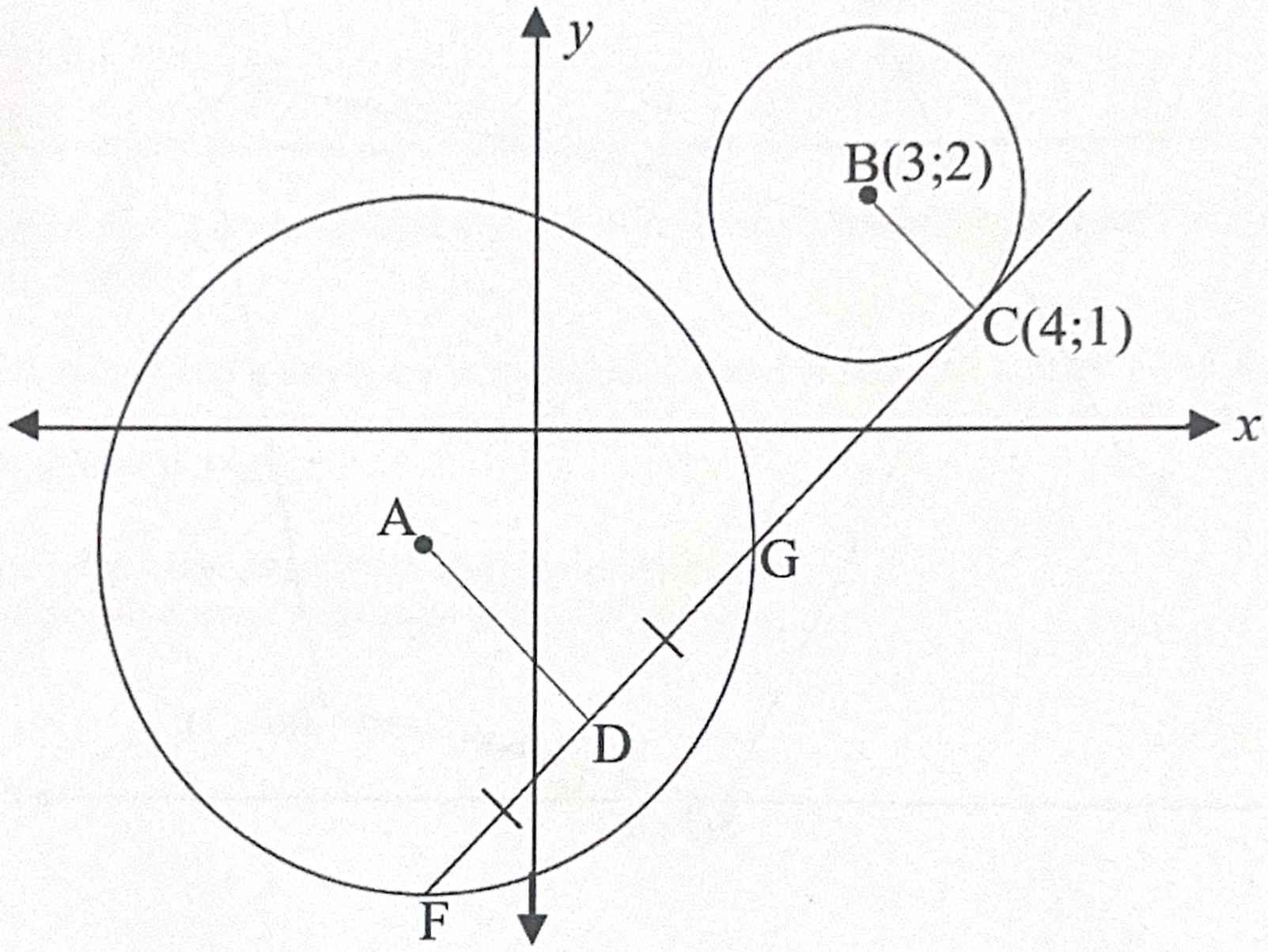
3.7 Calculate the value of θ, the angle of inclination of SR. (2)

3.8 Calculate the equation of AB. Show ALL working. (6)
[26]

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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 = $\frac{\sqrt{10}}{2}$ 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]

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