SA-STUDENT

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"You have to ask yourself how badly do you want something? If you really, really want something then put in the work". -Lewis Hamilton

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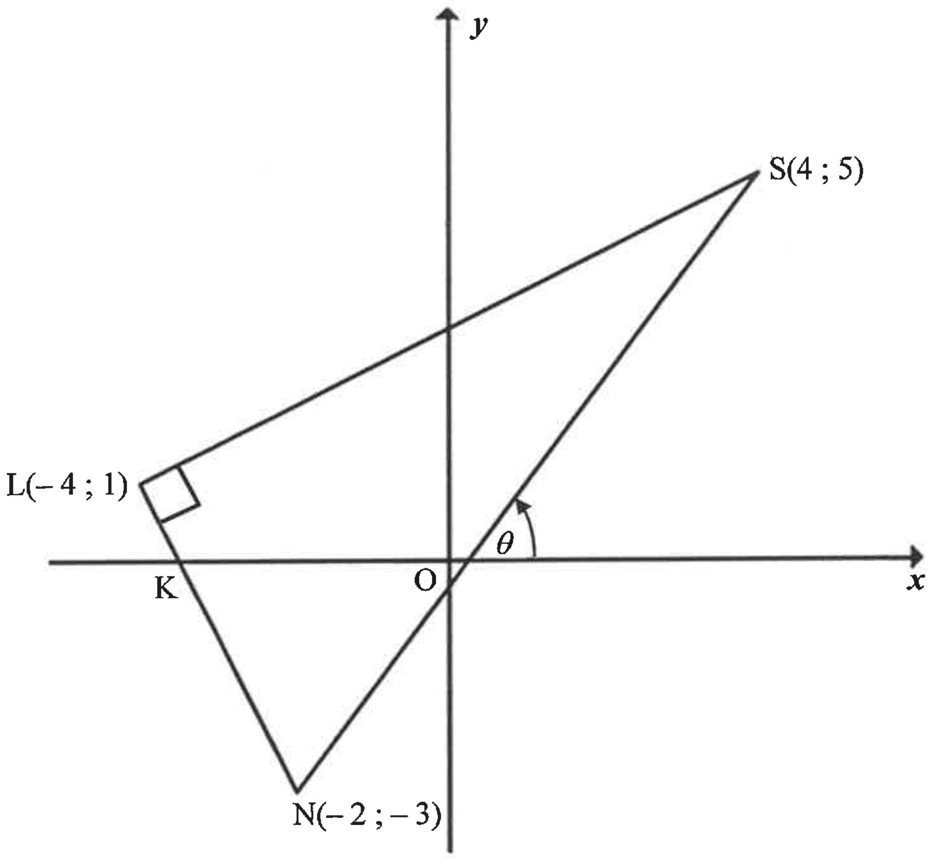
QUESTION 3

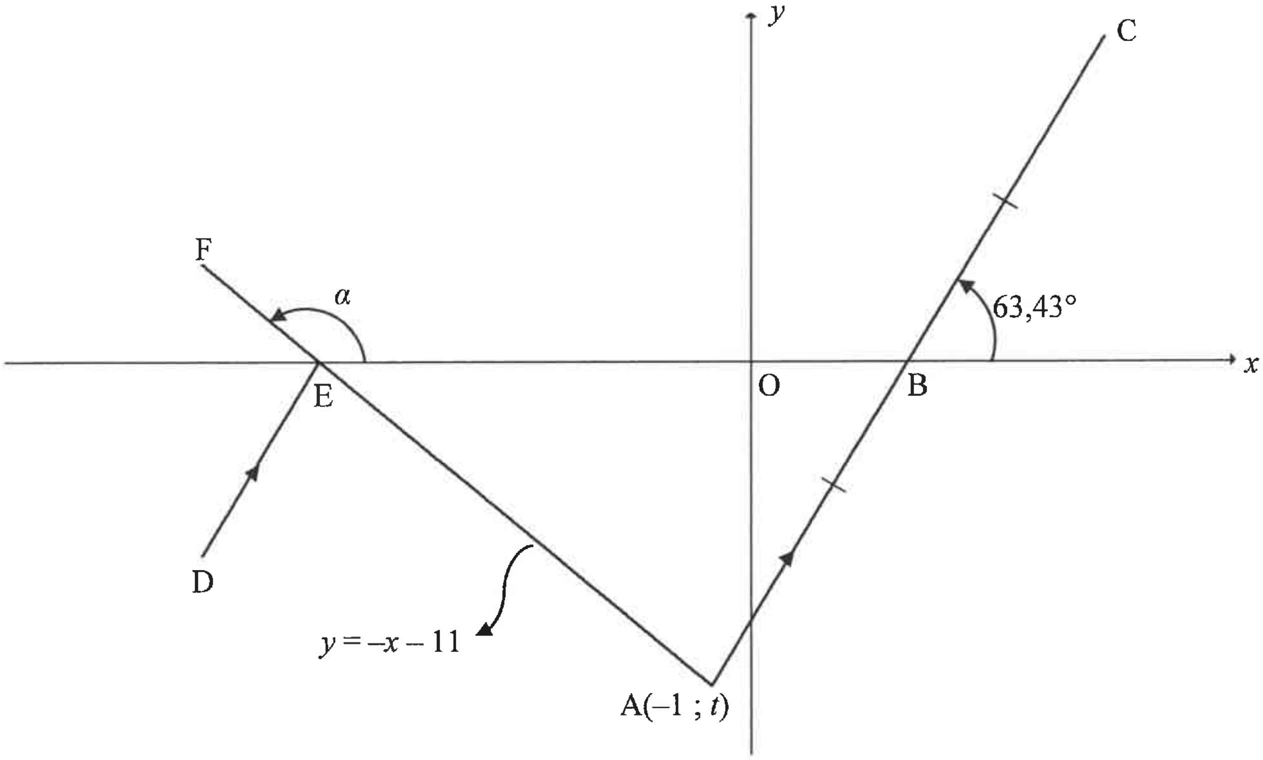
In the figure, L$(-4\ ;\ 1)$, S$(4\ ;\ 5)$ and N$(-2\ ;\ -3)$ are the vertices of a triangle having $S\hat{L}N = 90°$. LN intersects the x-axis at K.



3.1	Calculate the length of SL. Leave your answer in surd form.	(2)
3.2	Calculate the gradient of SN.	(2)
3.3	Calculate the size of θ, the angle of inclination of SN.	(2)
3.4	Calculate the size of $L\hat{N}S$.	(3)
3.5	Determine the equation of the line which passes through L and is parallel to SN. Write your answer in the form $y = mx + c$.	(3)
3.6	Calculate the area of ΔLSN.	(3)
3.7	Calculate the coordinates of point P, which is equidistant from L, S and N.	(3)
3.8	Calculate the size of $L\hat{P}S$.	(2)
		[20]

QUESTION 3

In the diagram, the equation of line AF is $y = -x - 11$. B, a point on the x-axis, is the midpoint of the straight line joining A$(-1\,;\,t)$ and C. The angles of inclination of AF and AC are α and $63{,}43°$ respectively. AF cuts the x-axis in E. D is a point such that DE || AC.



3.1 Calculate the:

3.1.1 Value of t (2)

3.1.2 Size of α (2)

3.1.3 Gradient of AC, to the nearest whole number (2)

3.2 Determine the equation of AC in the form $y = mx + k$. (2)

3.3 Calculate the:

3.3.1 Coordinates of C (3)

3.3.2 Size of $\hat{FED}$ (3)

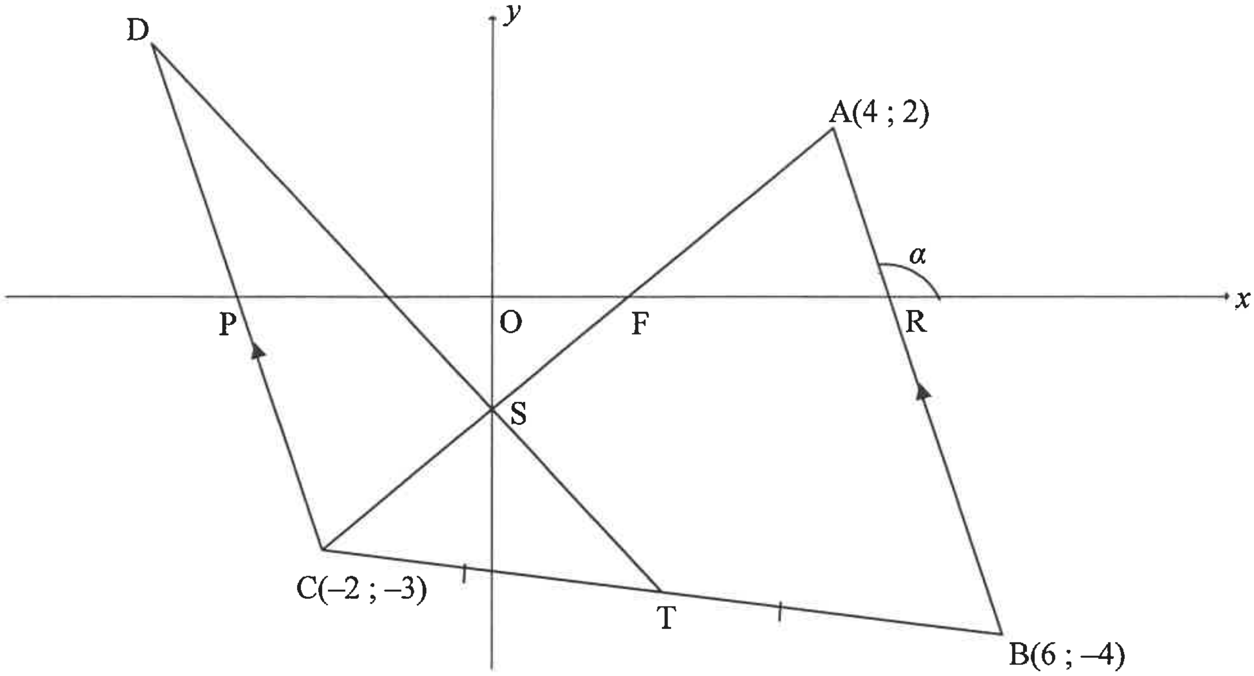
3.4 G is a point such that EAGC, in that order, is a parallelogram.

Determine the equation of a circle centred at G and passing through the point B. Write your answer in the form $(x-a)^2 + (y-b)^2 = r^2$. (4)

[18]

QUESTION 3

In the diagram, A(4 ; 2), B(6 ; –4) and C(–2 ; –3) are vertices of ΔABC. T is the midpoint of CB. The equation of line AC is $5x-6y=8$. The angle of inclination of AB is α. ΔDCT is drawn such that CD || BA. The lines AC and DT intersect at S, the y-intercept of AC. P, F and R are the x-intercepts of DC, AC and AB respectively.



3.1 Calculate the:

3.1.1 Gradient of AB (2)

3.1.2 Size of α (2)

3.1.3 Coordinates of T (2)

3.1.4 Coordinates of S (2)

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

3.3 Calculate the:

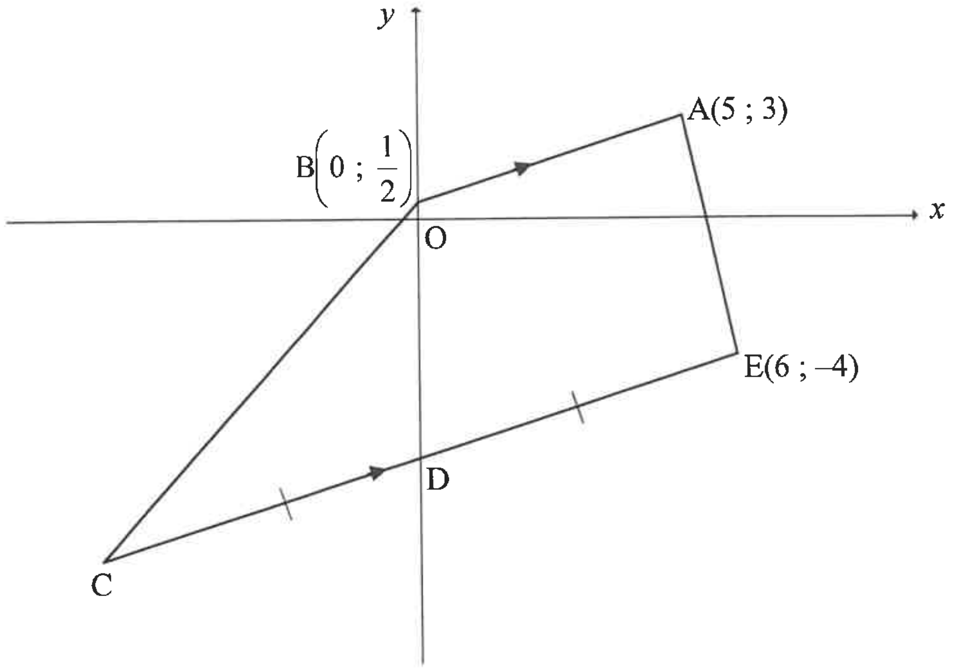
3.3.1 Size of $D\hat{C}A$ (4)

3.3.2 Area of POSC (5)

[20]

QUESTION 3

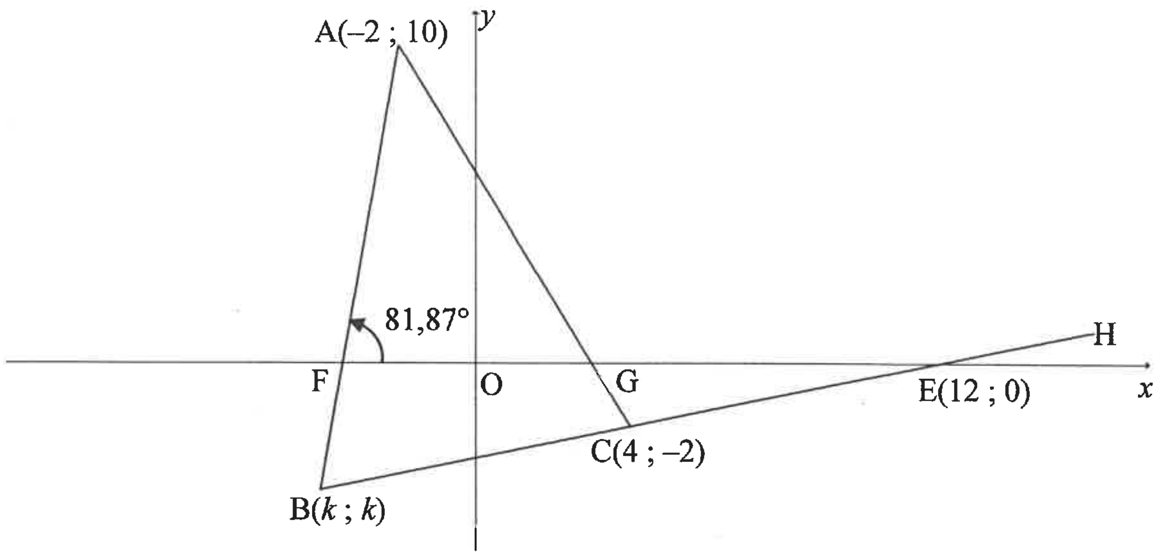
In the diagram, A(5 ; 3), $B\left(0 ; \frac{1}{2}\right)$, C and E(6 ; –4) are the vertices of a trapezium having BA || CE. D is the y-intercept of CE and CD = DE.



3.1	Calculate the gradient of AB.	(2)
3.2	Determine the equation of CE in the form $y = mx + c$.	(3)
3.3	Calculate the:	
	3.3.1 Coordinates of C	(3)
	3.3.2 Area of quadrilateral ABCD	(4)
3.4	If point K is the reflection of E in the y-axis:	
	3.4.1 Write down the coordinates of K	(2)
	3.4.2 Calculate the:	
	(a) Perimeter of ΔKEC	(4)
	(b) Size of $K\hat{C}E$	(3) **[21]**

QUESTION 3

In the diagram, A(–2 ; 10), B(k ; k) and C(4 ; –2) are the vertices of ΔABC. Line BC is produced to H and cuts the x-axis at E(12 ; 0). AB and AC intersects the x-axis at F and G respectively. The angle of inclination of line AB is 81,87°.



3.1 Calculate the gradient of:

3.1.1 BE (2)

3.1.2 AB (2)

3.2 Determine the equation of BE in the form $y = mx + c$ (2)

3.3 Calculate the:

3.3.1 Coordinates of B, where $k < 0$ (2)

3.3.2 Size of $\hat{A}$ (4)

3.3.3 Coordinates of the point of intersection of the diagonals of parallelogram ACES, where S is a point in the first quadrant (2)

3.4 Another point T(p ; p), where $p > 0$, is plotted such that $ET = BE = 4\sqrt{17}$ units.

3.4.1 Calculate the coordinates of T. (5)

3.4.2 Determine the equation of the:

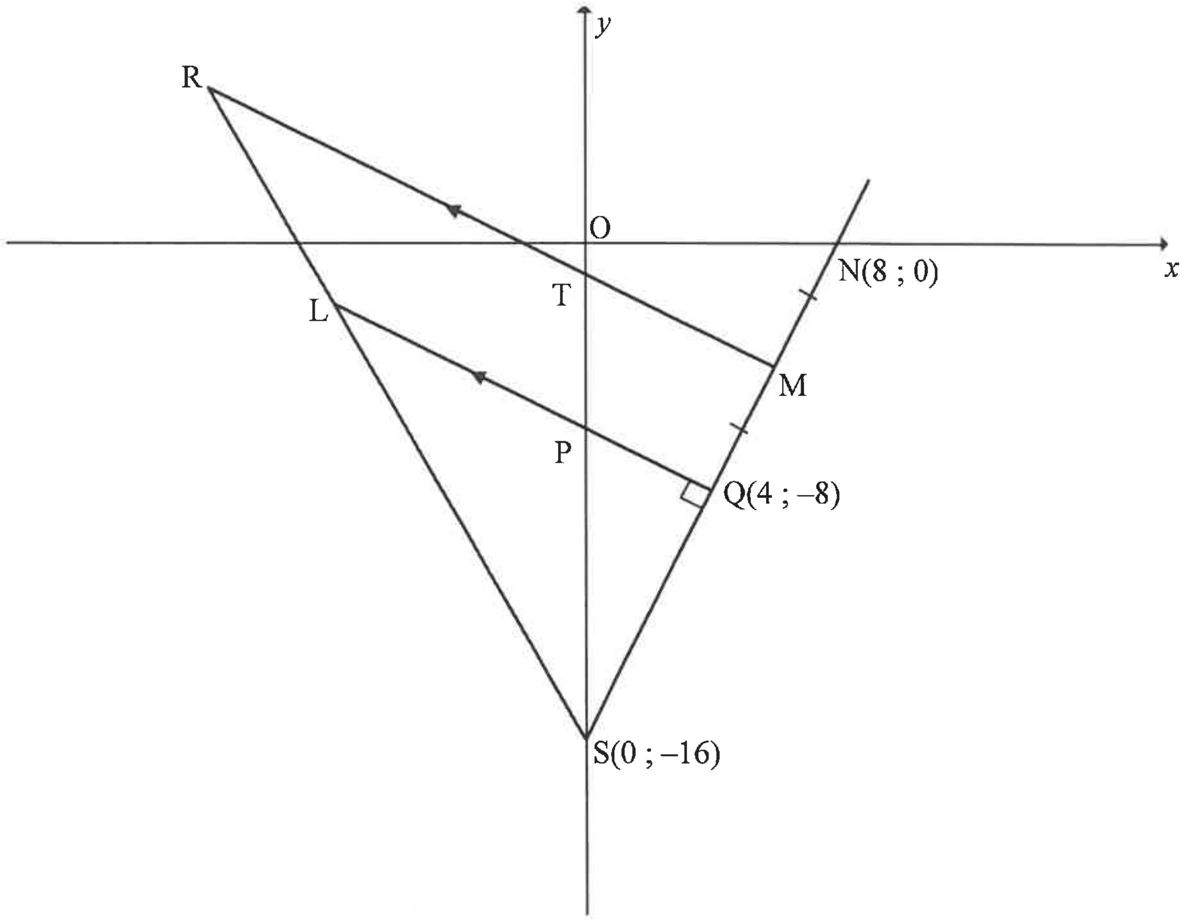
(a) Circle with centre at E and passing through B and T in the form $(x-a)^2 + (y-b)^2 = r^2$ (2)

(b) Tangent to the circle at point B(k ; k) (3)

[24]

QUESTION 3

In the diagram, S(0 ; –16), L and Q(4 ; –8) are the vertices of ΔSLQ having LQ perpendicular to SQ. SL and SQ are produced to points R and M respectively such that RM || LQ. SM produced cuts the x-axis at N(8 ; 0). QM = MN. T and P are the y-intercepts of RM and LQ respectively.

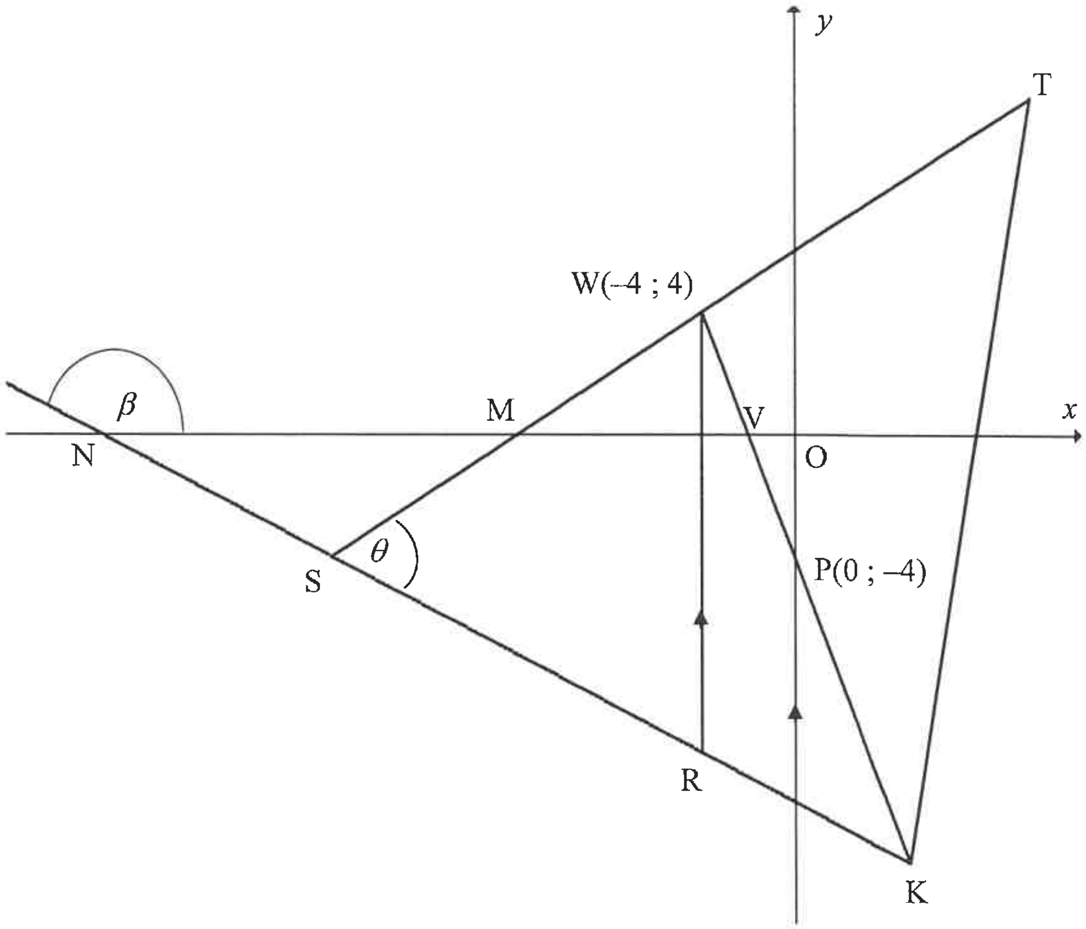


3.1	Calculate the coordinates of M.	(2)
3.2	Calculate the gradient of NS.	(2)
3.3	Show that the equation of line LQ is $y = -\frac{1}{2}x - 6$.	(3)
3.4	Determine the equation of a circle having centre at O, the origin, and also passing through S.	(2)
3.5	Calculate the coordinates of T.	(3)
3.6	Determine $\frac{\text{LS}}{\text{RS}}$.	(3)
3.7	Calculate the area of PTMQ.	(4)

[19]

QUESTION 3

ΔTSK is drawn. The equation of ST is $y = \frac{1}{2}x + 6$ and ST cuts the x-axis at M. W(–4 ; 4) lies on ST and R lies on SK such that WR is parallel to the y-axis. WK cuts the x-axis at V and the y-axis at P(0 ; –4). KS produced cuts the x-axis at N. $T\hat{S}K = \theta$.



3.1 Calculate the gradient of WP. (2)

3.2 Show that $WP \perp ST$. (2)

3.3 If the equation of SK is given as $5y + 2x + 60 = 0$, calculate the coordinates of S. (4)

3.4 Calculate the length of WR. (4)

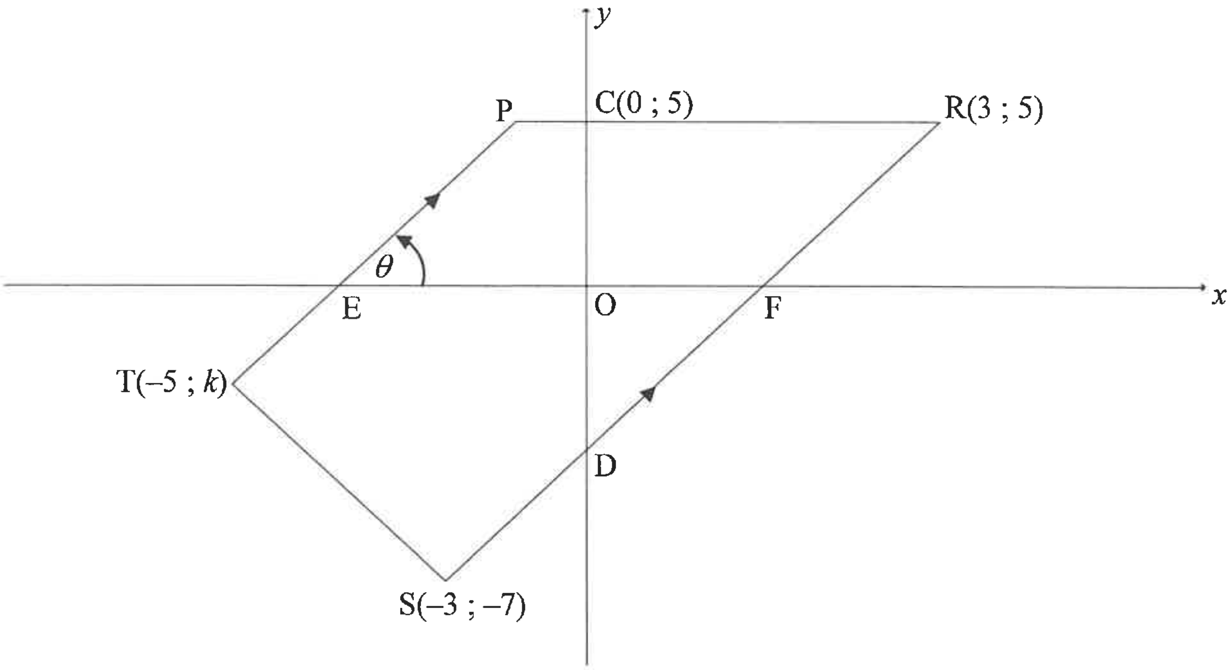
3.5 Calculate the size of θ. (5)

3.6 Let L be a point in the third quadrant such that SWRL, in that order, forms a parallelogram. Calculate the area of SWRL. (4)

[21]

QUESTION 3

In the diagram, P, R(3 ; 5), S(–3 ; –7) and T(–5 ; k) are vertices of trapezium PRST and PT || RS. RS and PR cut the y-axis at D and C(0 ; 5) respectively. PT and RS cut the x-axis at E and F respectively. $P\hat{E}F = \theta$.



3.1 Write down the equation of PR. (1)

3.2 Calculate the:

3.2.1 Gradient of RS (2)

3.2.2 Size of θ (3)

3.2.3 Coordinates of D (3)

3.3 If it is given that $TS = 2\sqrt{5}$, calculate the value of k. (4)

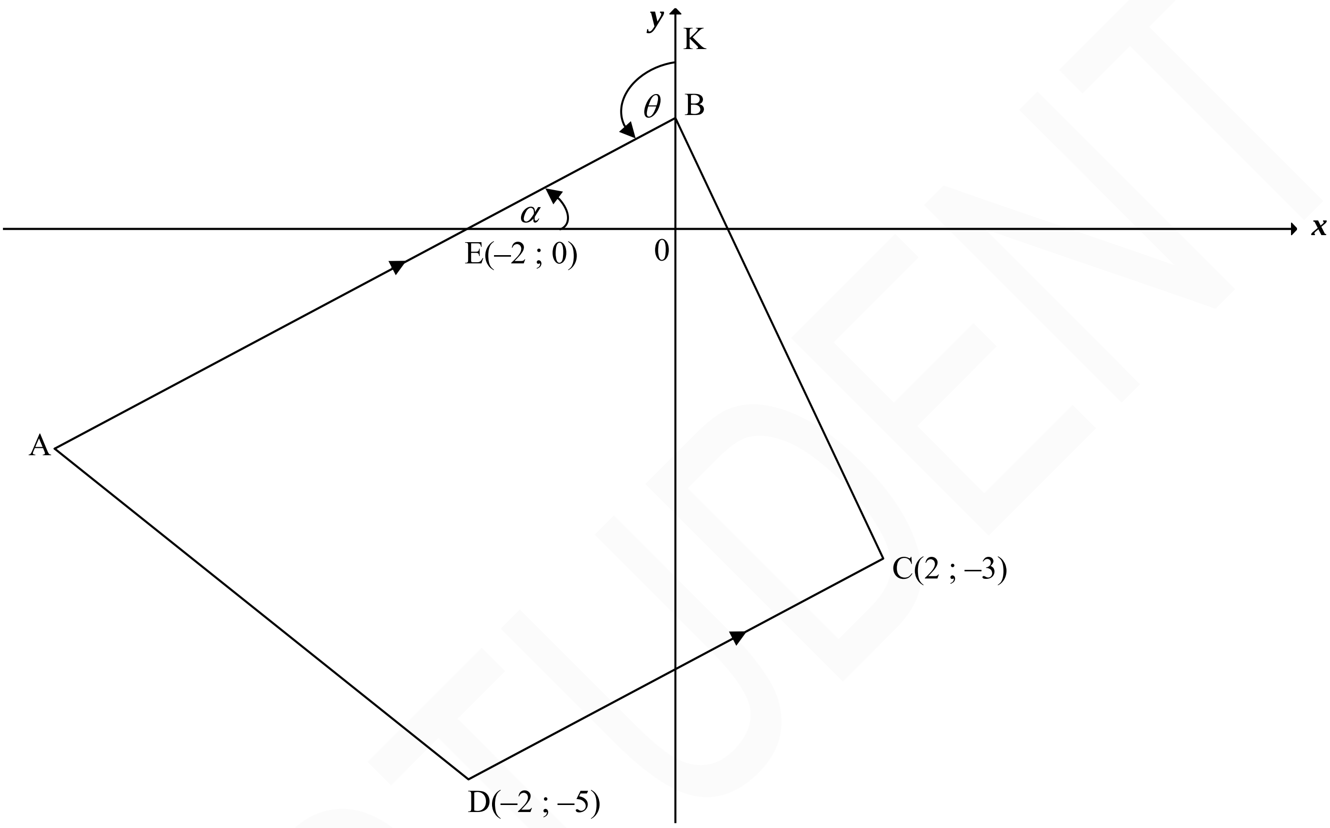
3.4 Parallelogram TDNS, with N in the 4^{th} quadrant, is drawn. Calculate the coordinates of N. (3)

3.5 ΔPRD is reflected about the y-axis to form $\Delta P'R'D'$. Calculate the size of $R\hat{D}R'$. (3)

[19]

QUESTION 3

In the diagram, A, B, C(2 ; –3) and D(–2 ; –5) are vertices of a trapezium with AB || DC. E(–2 ; 0) is the x-intercept of AB. The inclination of AB is α. K lies on the y-axis and $K\hat{B}E = \theta$.



3.1 Determine:

3.1.1 The midpoint of EC (2)

3.1.2 The gradient of DC (2)

3.1.3 The equation of AB in the form $y = mx + c$ (3)

3.1.4 The size of θ (3)

3.2 Prove that AB $\perp$ BC. (3)

3.3 The points E, B and C lie on the circumference of a circle. Determine:

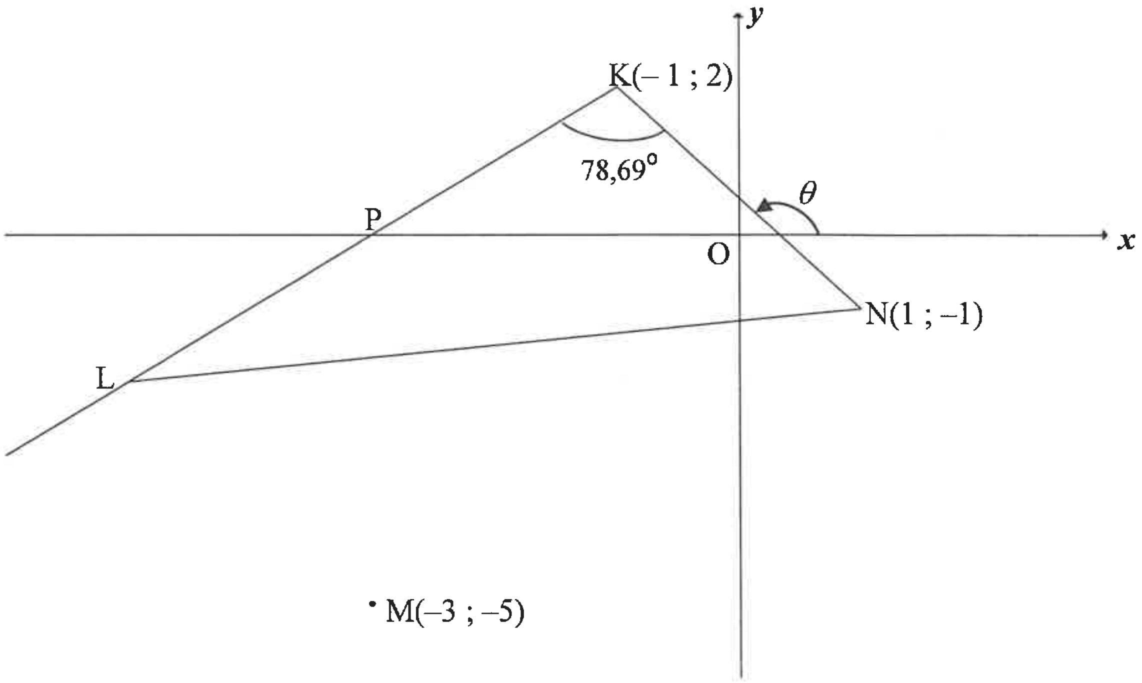
3.3.1 The centre of the circle (1)

3.3.2 The equation of the circle in the form $(x-a)^2 + (y-b)^2 = r^2$ (4)

[18]

QUESTION 3

In the diagram, K(– 1 ; 2), L and N(1 ; – 1) are vertices of ΔKLN such that $L\hat{K}N = 78{,}69°$. KL intersects the x-axis at P. KL is produced. The inclination of KN is θ. The coordinates of M are (–3 ; –5).



3.1 Calculate:

3.1.1 The gradient of KN (2)

3.1.2 The size of θ, the inclination of KN (2)

3.2 Show that the gradient of KL is equal to 1. (2)

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

3.4 Calculate the length of KN. (2)

3.5 It is further given that KN = LM.

3.5.1 Calculate the possible coordinates of L. (5)

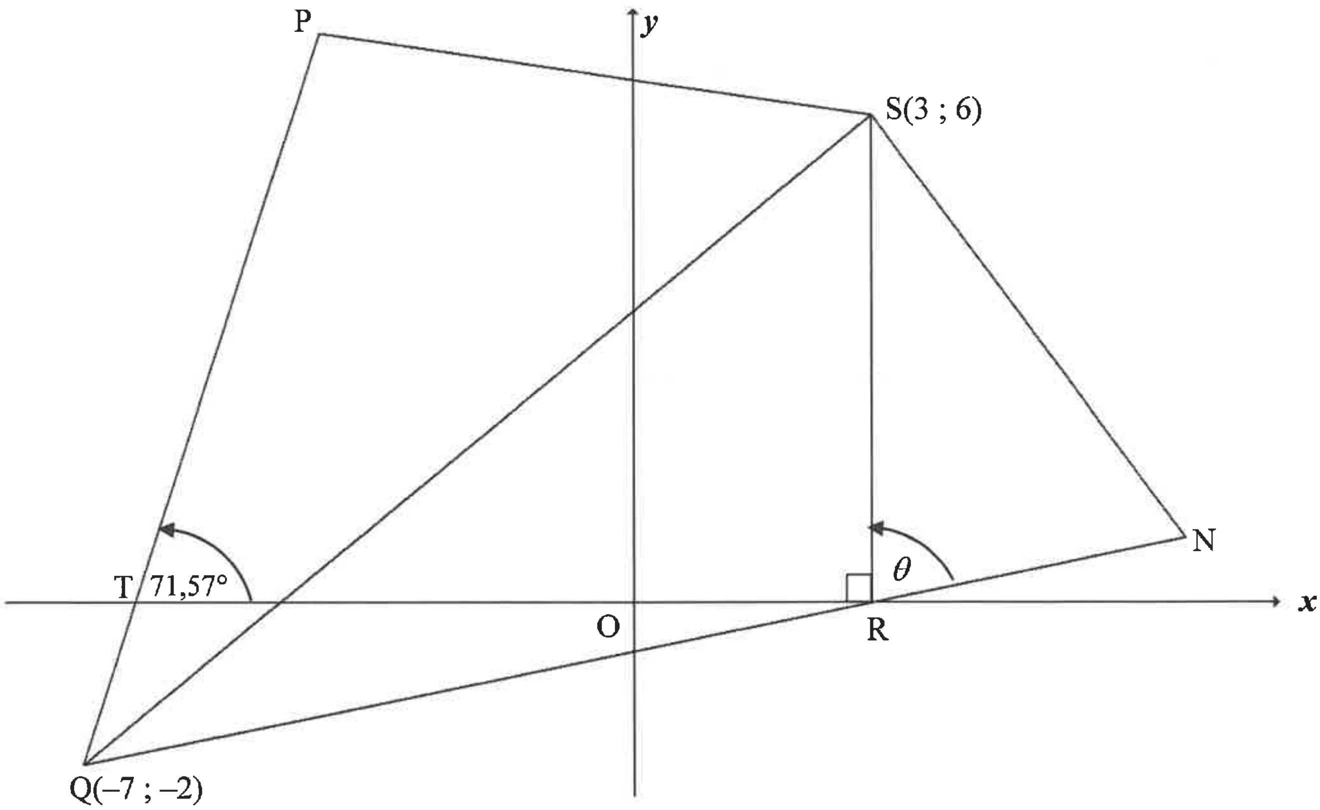
3.5.2 Determine the coordinates of L if it is given that KLMN is a parallelogram. (3)

3.6 T is a point on KL produced. TM is drawn such that TM = LM. Calculate the area of ΔKTN. (4)

[22]

QUESTION 3

In the diagram, P, Q(–7 ; –2), R and S(3 ; 6) are vertices of a quadrilateral. R is a point on the x-axis. QR is produced to N such that QR = 2RN. SN is drawn. $P\hat{T}O = 71{,}57°$ and $S\hat{R}N = \theta$.

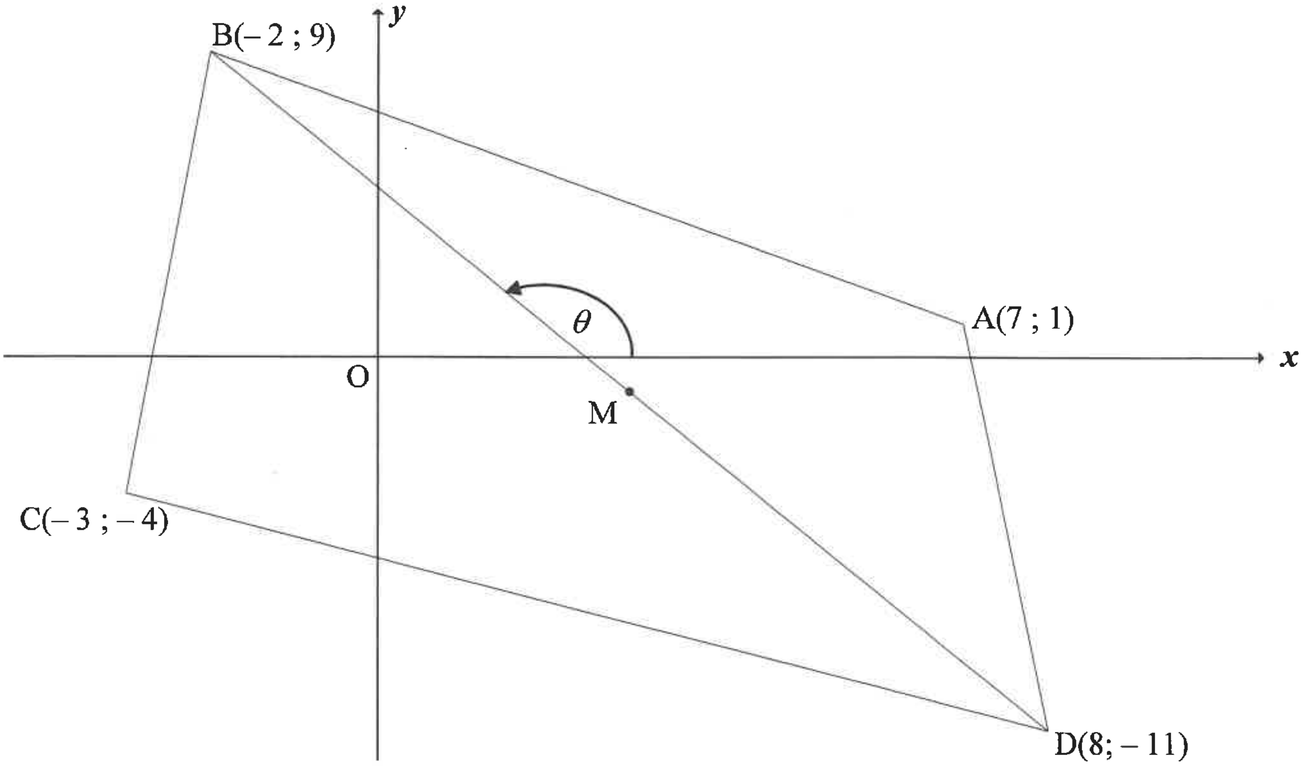


Determine:

3.1	The equation of SR	(1)
3.2	The gradient of QP to the nearest integer	(2)
3.3	The equation of QP in the form $y = mx + c$	(2)
3.4	The length of QR. Leave your answer **in surd form**.	(2)
3.5	$\tan(90° - \theta)$	(3)
3.6	The area of ΔRSN , **without using a calculator**	(6)
		[16]

QUESTION 3

In the diagram, ABCD is a quadrilateral having vertices A(7 ; 1), B(– 2 ; 9), C(– 3 ; – 4) and D(8 ; – 11). M is the midpoint of BD.

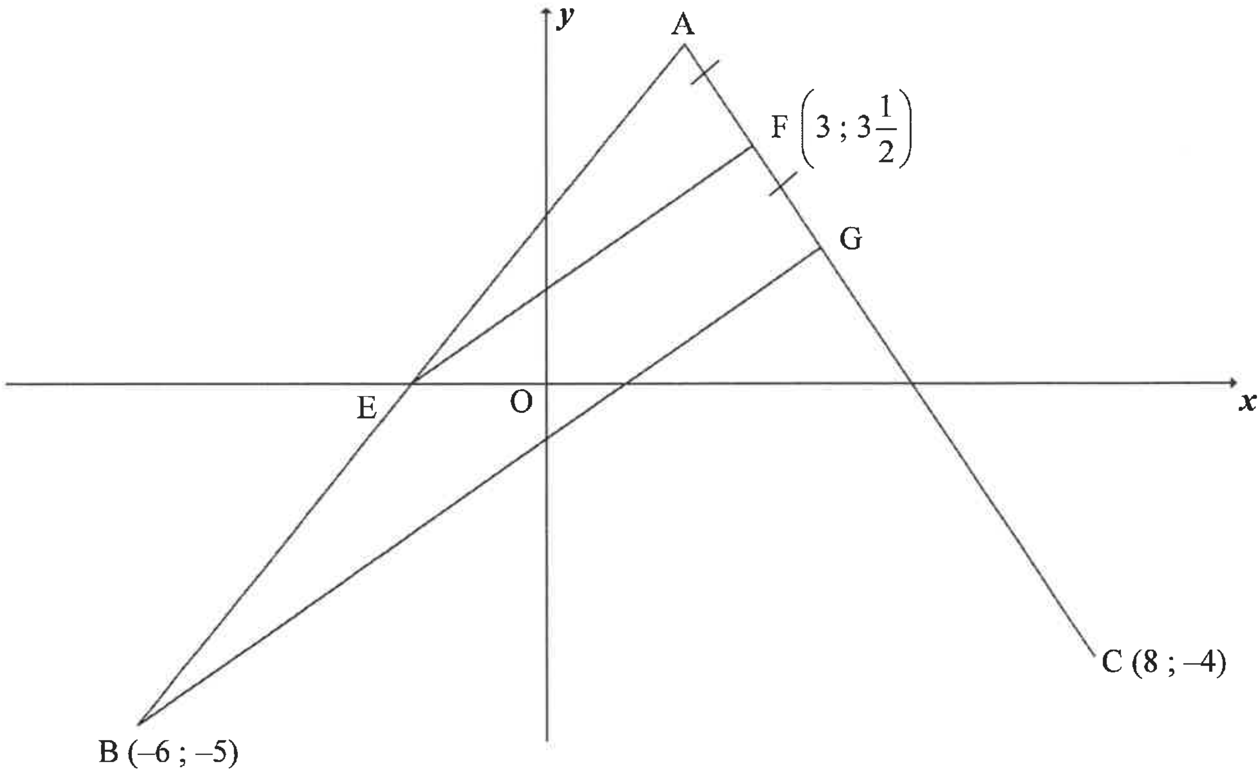


3.1	Calculate the gradient of AC.		(2)
3.2	Determine:		
	3.2.1	The equation of AC in the form $y = mx + c$	(2)
	3.2.2	Whether M lies on AC	(4)
3.3	Prove that BD $\perp$ AC.		(3)
3.4	Calculate:		
	3.4.1	θ, the inclination of BD	(2)
	3.4.2	The size of $C\hat{B}D$	(3)
	3.4.3	The length of AC	(2)
	3.4.4	The area of ABCD	(5)

[23]

QUESTION 3

In the diagram, A, B(–6 ; –5) and C(8 ; –4) are points in the Cartesian plane. $F\left(3;\ 3\frac{1}{2}\right)$ and G are points on line AC such that AF = FG. E is the x-intercept of AB.



3.1 Calculate:

3.1.1 The equation of AC in the form $y = mx + c$ (4)

3.1.2 The coordinates of G if the equation of BG is $7x - 10y = 8$ (3)

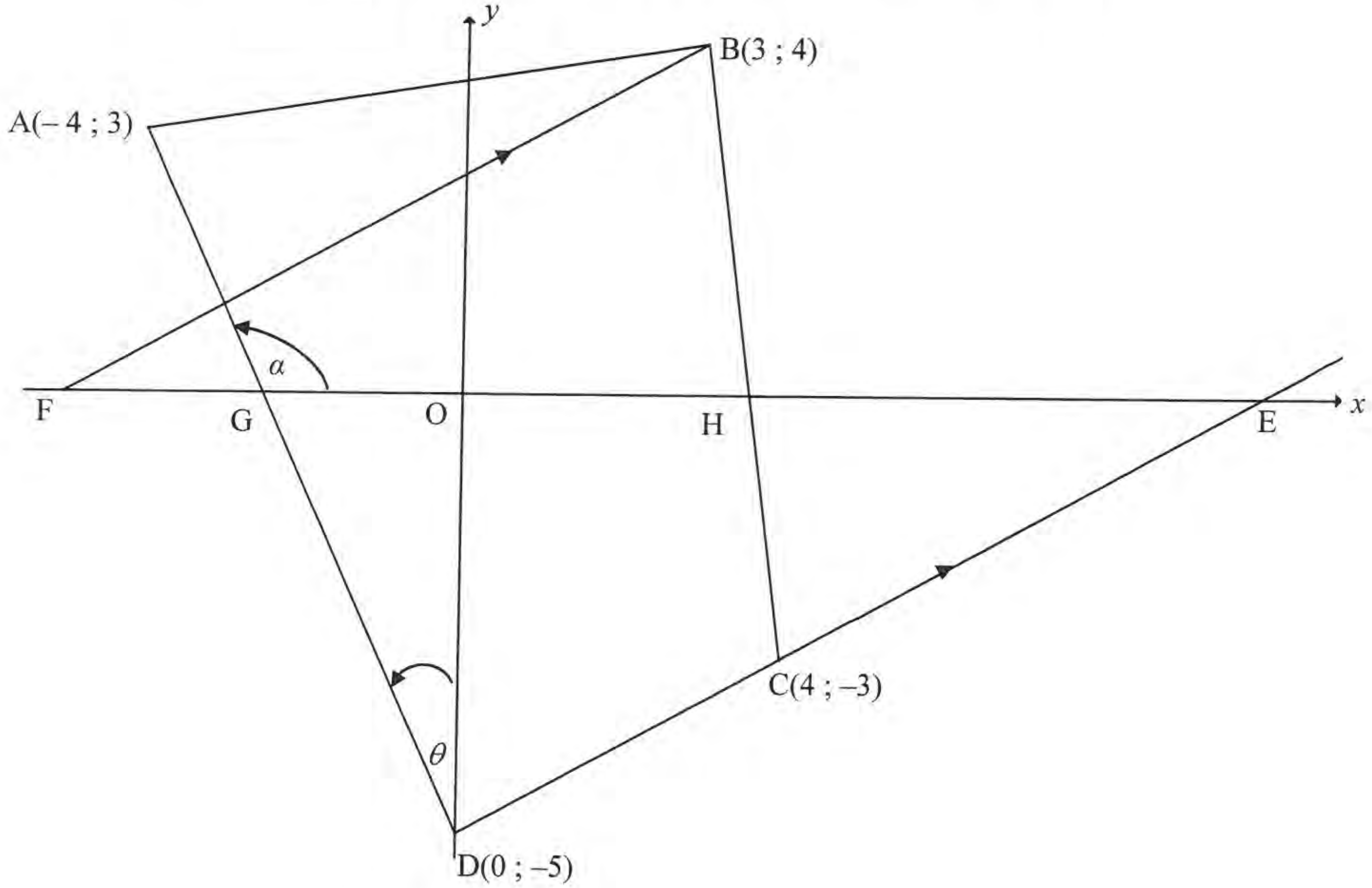
3.2 Show by calculation that the coordinates of A is (2 ; 5). (2)

3.3 Prove that EF || BG. (4)

3.4 ABCD is a parallelogram with D in the first quadrant. Calculate the coordinates of D. (4)
[17]

QUESTION 3

In the diagram, ABCD is a quadrilateral having vertices A(– 4 ; 3), B(3 ; 4), C(4 ; –3) and D(0 ; –5). DC produced cuts the x-axis at E, BC cuts the x-axis at H and AD cuts the x-axis at G. F is a point on the x-axis such that BF || DE. $A\hat{G}O = \alpha$ and $A\hat{D}O = \theta$.



3.1 Calculate the gradient of DC. (2)

3.2 Prove that AD ⊥ DC. (3)

3.3 Show by calculation that ΔABC is an isosceles. (4)

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

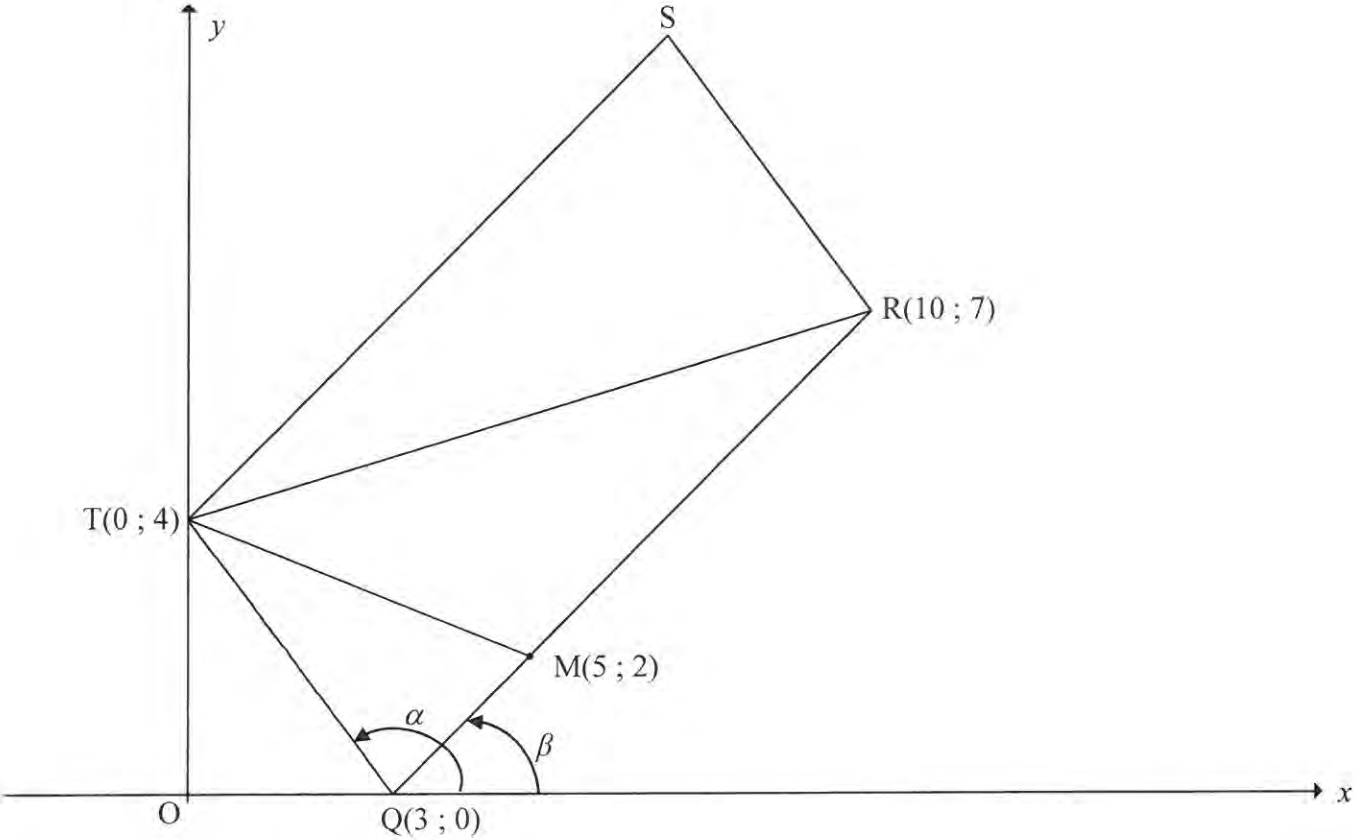
3.5 Calculate the size of θ. (3)

3.6 Determine the equation of the circle, with the centre as the origin and passing through point C, in the form $x^2 + y^2 = r^2$. (2)

[17]

QUESTION 3

In the diagram, Q(3 ; 0), R(10 ; 7), S and T(0 ; 4) are the vertices of parallelogram QRST. From T a straight line is drawn to meet QR at M(5 ; 2). The angles of inclination of TQ and RQ are α and β respectively.



3.1 Calculate the gradient of TQ. (1)

3.2 Calculate the length of RQ. Leave your answer in surd form. (2)

3.3 F(k ; –8) is a point in the Cartesian plane such that T, Q and F are collinear. Calculate the value of k. (4)

3.4 Calculate the coordinates of S. (4)

3.5 Calculate the size of $T\hat{S}R$. (6)

3.6 Calculate, in the simplest form, the ratio of:

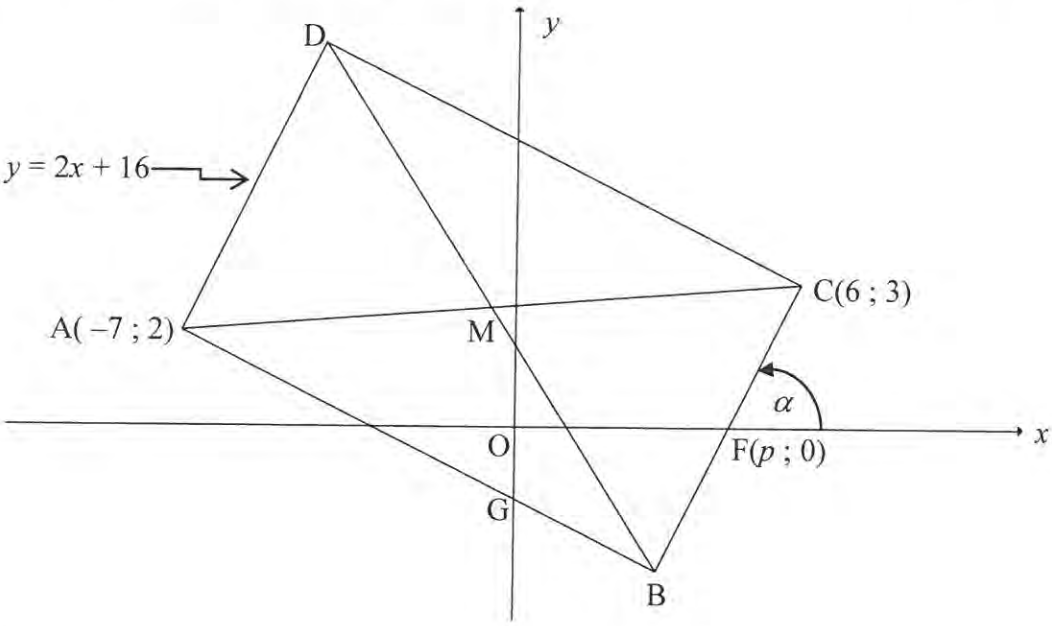
3.6.1 $\frac{MQ}{RQ}$ (3)

3.6.2 $\frac{\text{area of } \Delta TQM}{\text{area of parallelogram RQTS}}$ (3)

[23]

QUESTION 3

In the diagram, A(–7 ; 2), B, C(6 ; 3) and D are the vertices of rectangle ABCD. The equation of AD is $y = 2x + 16$. Line AB cuts the y-axis at G. The x-intercept of line BC is F(p ; 0) and the angle of inclination of BC with the positive x-axis is α. The diagonals of the rectangle intersect at M.



3.1 Calculate the coordinates of M. (2)

3.2 Write down the gradient of BC in terms of p. (1)

3.3 Hence, calculate the value of p. (3)

3.4 Calculate the length of DB. (3)

3.5 Calculate the size of α. (2)

3.6 Calculate the size of $\hat{OGB}$. (3)

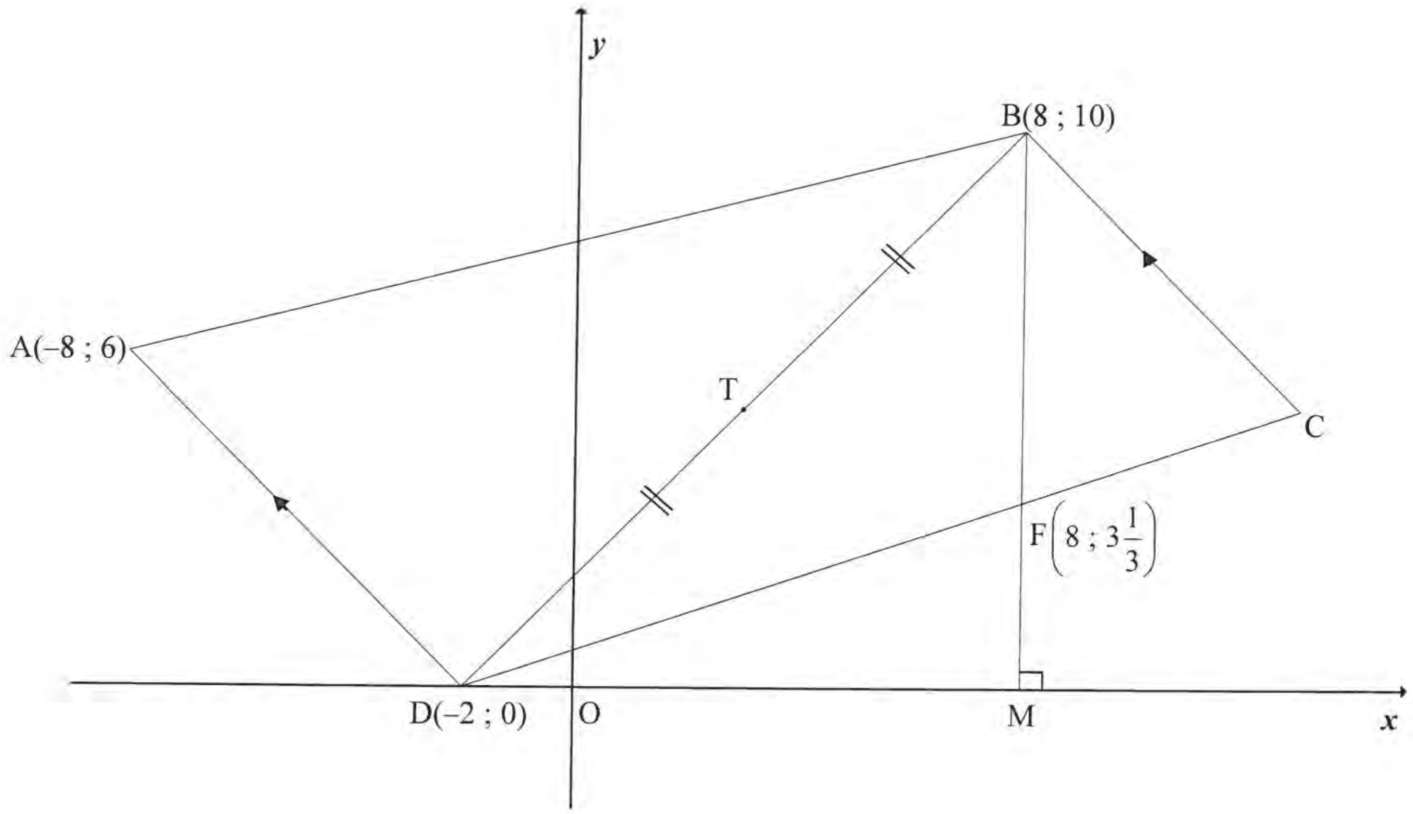
3.7 Determine the equation of the circle passing through points D, B and C in the form $(x-a)^2+(y-b)^2=r^2$. (3)

3.8 If AD is shifted so that ABCD becomes a square, will BC be a tangent to the circle passing through points A, M and B, where M is now the intersection of the diagonals of the square ABCD? Motivate your answer. (2)

[19]

QUESTION 3

In the diagram below (not drawn to scale) A(–8 ; 6), B(8 ; 10), C and D(–2 ; 0) are the vertices of a trapezium having BC | | AD. T is the midpoint of DB. From B, the straight line drawn parallel to the y-axis cuts DC in $F\left(8\ ;\ 3\frac{1}{3}\right)$ and the x-axis in M.

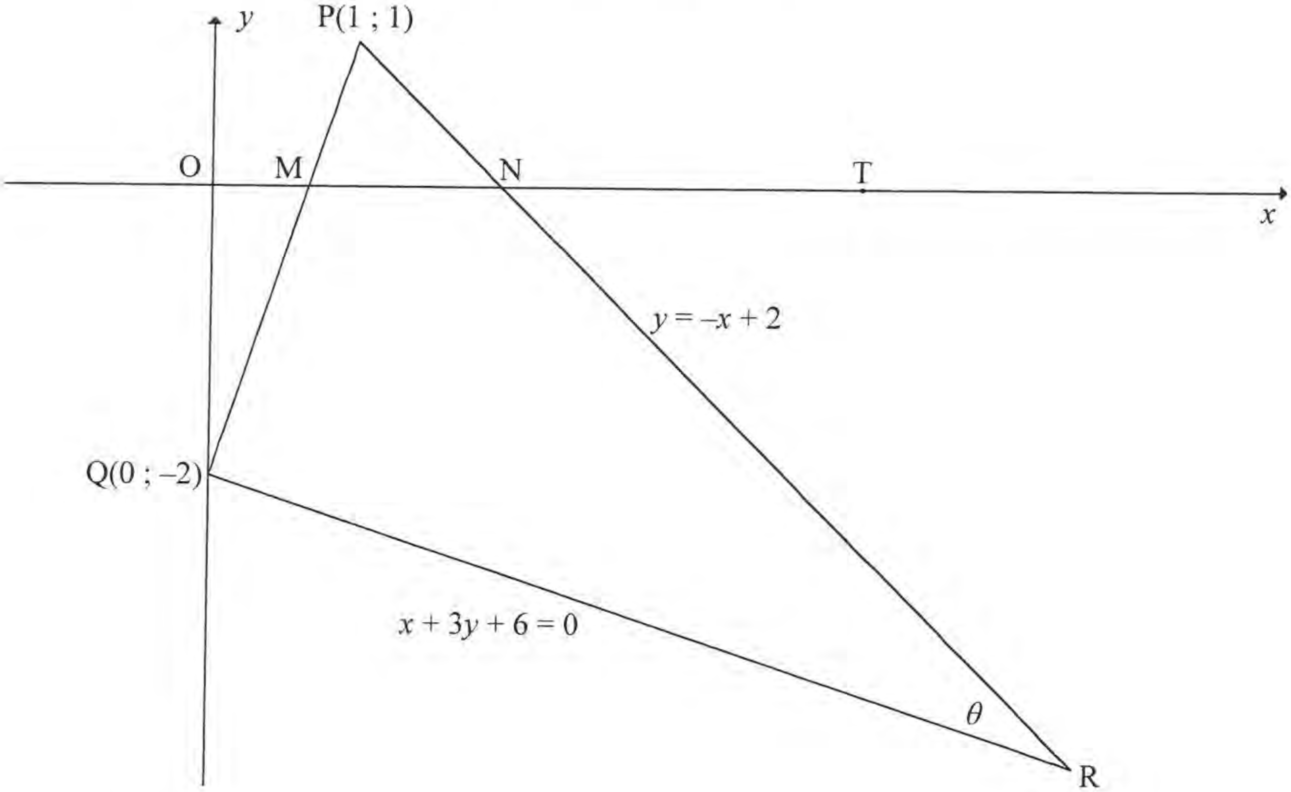


3.1	Calculate the gradient of AD.	(2)
3.2	Determine the equation of BC in the form $y = mx + c$.	(3)
3.3	Prove that BD $\perp$ AD.	(3)
3.4	Calculate the size of $B\hat{D}M$.	(2)
3.5	If it is given that TC | | DM and points T and C are symmetrical about line BM, calculate the coordinates of C.	(3)
3.6	Calculate the area of ΔBDF.	(5)

[18]

QUESTION 3

In the diagram below, P(1 ; 1), Q(0 ; –2) and R are the vertices of a triangle and $P\hat{R}Q = \theta$. The x-intercepts of PQ and PR are M and N respectively. The equations of the sides PR and QR are $y = -x + 2$ and $x + 3y + 6 = 0$ respectively. T is a point on the x-axis, as shown.



3.1 Determine the gradient of QP. (2)

3.2 Prove that $P\hat{Q}R = 90°$. (2)

3.3 Determine the coordinates of R. (3)

3.4 Calculate the length of PR. Leave your answer in surd form. (2)

3.5 Determine the equation of a circle passing through P, Q and R in the form $(x-a)^2 + (y-b)^2 = r^2$. (6)

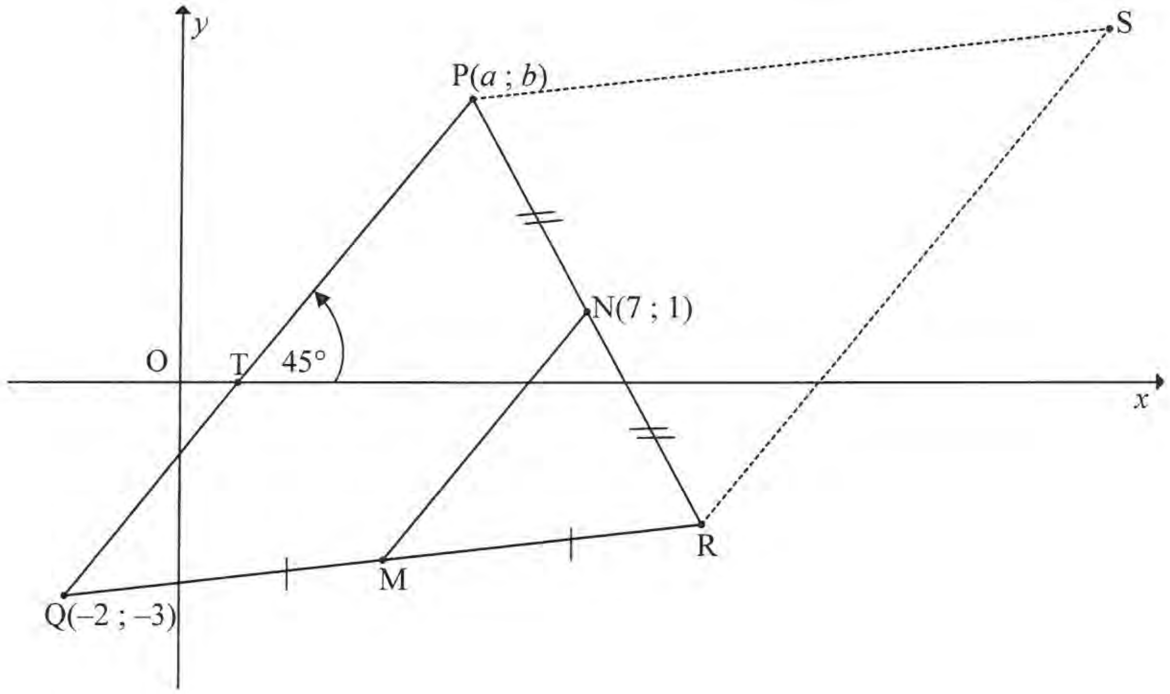
3.6 Determine the equation of a tangent to the circle passing through P, Q and R at point P in the form $y = mx + c$. (3)

3.7 Calculate the size of θ. (5)

[23]

QUESTION 3

In the diagram below, the line joining Q(–2 ; –3) and P(a ; b), a and $b > 0$, makes an angle of 45° with the positive x-axis. QP = $7\sqrt{2}$ units. N(7 ; 1) is the midpoint of PR and M is the midpoint of QR.

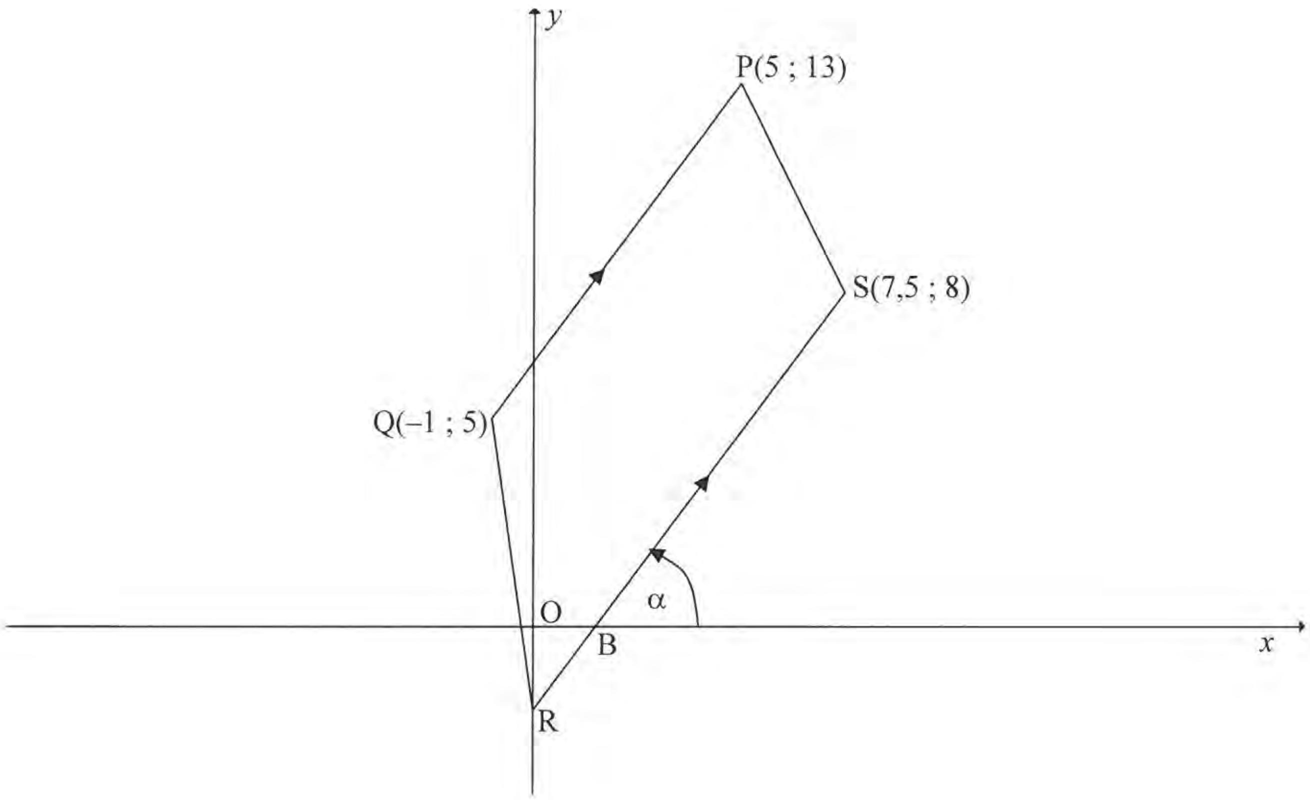


Determine:

3.1	The gradient of PQ	(2)
3.2	The equation of MN in the form $y = mx + c$ and give reasons	(4)
3.3	The length of MN	(2)
3.4	The length of RS	(1)
3.5	The coordinates of S such that PQRS, in this order, is a parallelogram	(3)
3.6	The coordinates of P	(6)
		[18]

QUESTION 3

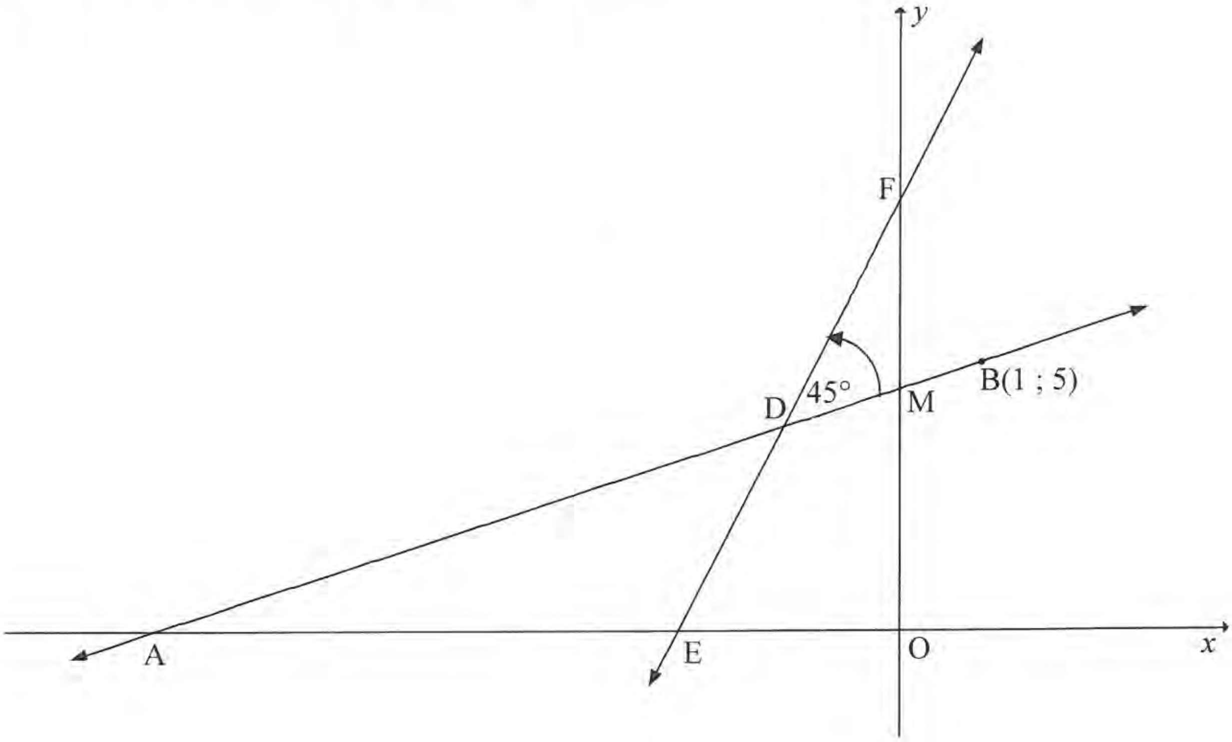
In the diagram below points P(5 ; 13), Q(–1 ; 5) and S(7,5 ; 8) are given. SR | | PQ where R is the y-intercept of SR. The x-intercept of SR is B. QR is joined.



3.1	Calculate the length of PQ.	(3)
3.2	Calculate the gradient of PQ.	(2)
3.3	Determine the equation of line RS in the form $ax + by + c = 0$.	(4)
3.4	Determine the x-coordinate of B.	(2)
3.5	Calculate the size of $O\hat{R}B$.	(3)
3.6	Prove that QBSP is a parallelogram.	(4)
		[18]

QUESTION 4

In the diagram below, E and F respectively are the x- and y-intercepts of the line having equation $y = 3x + 8$. The line through B(1 ; 5) making an angle of 45° with EF, as shown below, has x- and y-intercepts A and M respectively.



4.1 Determine the coordinates of E. (2)

4.2 Calculate the size of $D\hat{A}E$. (3)

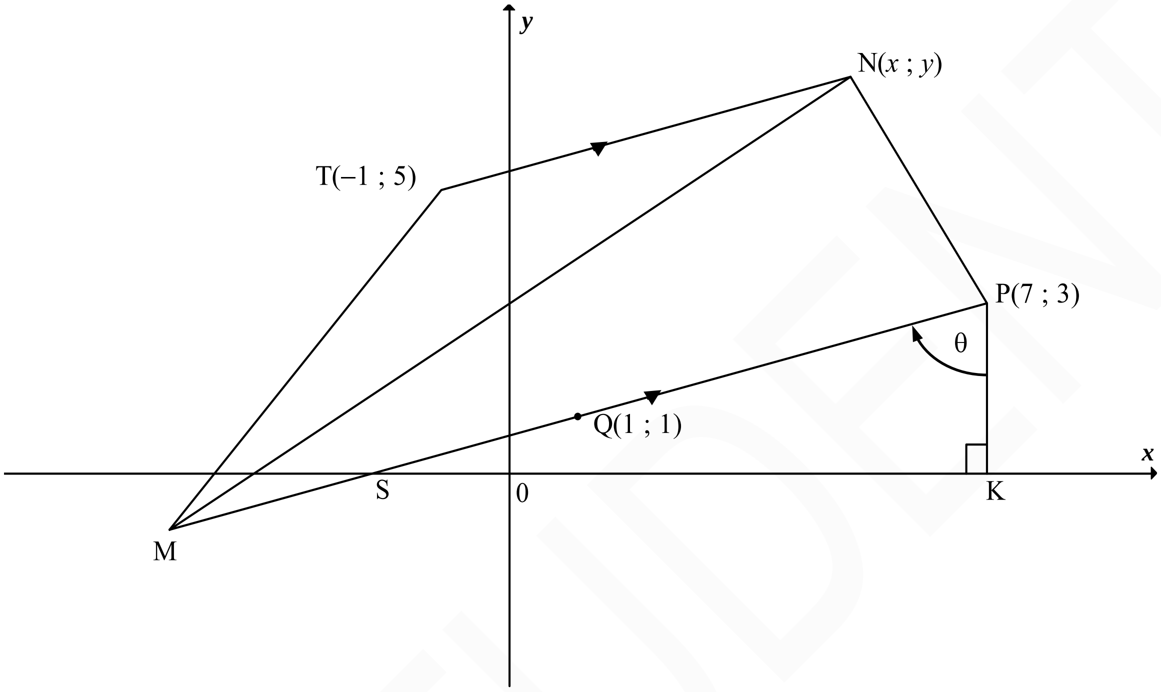
4.3 Determine the equation of AB in the form $y = mx + c$. (4)

4.4 If AB has equation $x - 2y + 9 = 0$, determine the coordinates of D. (4)

4.5 Calculate the area of quadrilateral DMOE. (6)
[19]

QUESTION 3

In the diagram below, M, T(–1 ; 5), N(x ; y) and P(7 ; 3) are vertices of trapezium MTNP having TN | | MP. Q(1 ; 1) is the midpoint of MP. PK is a vertical line and $S\hat{P}K = \theta$. The equation of NP is $y = -2x + 17$.



3.1 Write down the coordinates of K. (1)

3.2 Determine the coordinates of M. (2)

3.3 Determine the gradient of PM. (2)

3.4 Calculate the size of θ. (3)

3.5 Hence, or otherwise, determine the length of PS. (3)

3.6 Determine the coordinates of N. (5)

3.7 If A(a ; 5) lies in the Cartesian plane:

3.7.1 Write down the equation of the straight line representing the possible positions of A. (1)

3.7.2 Hence, or otherwise, calculate the value(s) of a for which $T\hat{A}Q = 45°$. (5)

[22]