1 Given $A = (4, 3)$ and O is the origin, L is a line through A cutting the positive axes at P and Q.

(i) Find the equation of L if ΔPOQ has an area of 24.5.

(ii) Find the equation of the lines L_1 and L_2, passing through A and at a distance $\sqrt{5}$ units from the origin.

(iii) If α is the acute angle between the lines L_1 and L_2. Find the value of α.

2 The line L passes through the intersection of

$$59x - 76y + 46 = 0 \text{ and } 44x - 27y + 57 = 0$$

If the y-intercept of L is 1, find

(a) the equation of L.

(b) the distance from the origin to L.

3 (a) Find the area of the triangle with vertices $A(-1, 2)$, $B(a - 3, a + 1)$, $C(a, a + 2)$.

(b) If these points are collinear, find the values of a.

(c) Find the equation of BC.

(d) If the line through B and C cuts x- and y-axis at P and Q respectively, find the coordinates of P and Q.

(e) If O is the origin, what is the value of a, when area of ΔPOQ is unity.

4 The line L: $(1 + \lambda)x + (3 - \lambda)y = 2(1 + 3\lambda)$ passes through a fixed point Q for any value of λ.

(a) Find the coordinate of Q.

(b) If $L // L_1$: $2x + 3y = 5$, find the equation of L.

(c) If L has x-intercept = 3, find its y-intercept.

5 Given two lines L_1: $x - 2y - 4 = 0$

L_2: $2x + y - 4 = 0$

Find a straight line passing through the intersection of L_1 and L_2 and

(a) with slope 2

(b) passing through $(3, -2)$

(c) perpendicular to $5x + 3y = 0$.

6 A is the point $(1, 3)$

(a) Find the equation of the straight line with slope m passing through A.

(b) Find the slopes of the straight lines which pass through A and are at distances $\sqrt{2}$ units from the point $(2, 6)$.

(c) Find the equation of the line through the point $(2, 6)$ cutting the two lines in (b) at points B and C, such that $AB = AC$.

(d) Calculate the area of the triangle ABC.

7 Two lines L_1 and L_2 pass through $A(1, 1)$ and intersect the line

L_3: $3x - y - 12 = 0$

at the points P and Q respectively. The acute angle between L_1 and L_2 and that between L_2 and L_3 are both θ, where $\tan\theta = \frac{1}{2}$, and L_1 is positively sloped.

(a) Find, without using tables, the slopes of L_1 and L_2.

(b) Find the equations of L_1 and L_2.

(c) Find the coordinates of P and Q.

Circle.

15. Find the equation of the circle such that

(a) it passes through the points $A(-2, 2)$, $B(2, 2)$ and $C(-2, -4)$.

(b) its centre is at $(-3, 0)$ and it touches the line $x - y - 10 = 0$.

(c) it passes through the point $(2, 3)$ and touches the line $2x - 3y - 13 = 0$ at $(2, -3)$.

(d) it passes through the points of intersection of the circles $x^2 + y^2 - 2x - 3y - 2 = 0$ and $x^2 + y^2 - 3x + y - 10 = 0$ and the point $P(-2, 1)$.

(e) it passes through the points of intersection of the line $x - y + 1 = 0$ and the circle $x^2 + y^2 + 2x - 2y + 1 = 0$, and its centre lies on the line $x + 3y = 3$.

(f) Find the equation of the smaller circle whose centre is at the point $(-1, 1)$ and which touches the circle $x^2 + y^2 - 4x - 2y - 11 = 0$.

16. Given the equation $x^2 + y^2 + 2kx - 4ky + 6k^2 - 2 = 0$.

(a) Find the range of values of k so that the equation represents a circle with radius greater than 1.

(b) Find the locus of the centre of the circle as k varies within the range in (a).

17. The circles C_1: $x^2 + y^2 - 7x + 11 = 0$ and
C_2: $x^2 + y^2 - 4x + 6y + 8 = 0$
touches each other externally at P. Find the coordinates of P.

18. Given: L: $y = x$
C: $(x - 2)^2 + (y - 10)^2 = 18$.

(a) Prove that L does not meet the circle C.

(b) Find the co-ordinates of the points N and F on the circle C which are respectively the nearest and the furthest from the line L.

19. The circles C_1: $x^2 + y^2 + 4x - 2y + 1 = 0$ and
C_2: $x^2 + y^2 + 10x + 4y + 19 = 0$
have a common chord AB.

(a) (i) Find the equation of AB.
(ii) Find the equation of the circle with AB as a chord such that the area of the circle is a minimum.

(b) The circle C_1 and another circle C_3 are concentric. If AB is a tangent to C_3, find the equation of C_3.

20. Given the circle C: $x^2 + y^2 + 4x + 2y + 4 = 0$

(a) Find the radius and the coordinates of the centre of C.

(b) Find the distance from the centre of C to the line $ax + by + c = 0$. Hence, or otherwise, find the equation of the two tangents to C which are parallel to L: $3x - 4y = 0$.

(c) Find the equation of the line passing through the centre of C and perpendicular to the line L. Hence, or otherwise, find the points of contact at which the two tangents obtained in (b) touch C.

21. A circle C: $x^2 + y^2 + 4x - 2y - 11 = 0$ and a straight line L: $x + y = 3$ intersect at A and B. Find the equation of

(a) the circle with AB as diameter.

(b) the circle which has its centre at $(4, -4)$ and bisects the circumference of C.

22. The line L: $y = mx - 2$ meets the circle C: $x^2 + y^2 = 1$ at the points $A(x_1, y_1)$ and $B(x_2, y_2)$.

(a) Show that the length of the chord AB is $2\sqrt{\dfrac{m^2 - 3}{m^2 + 1}}$.

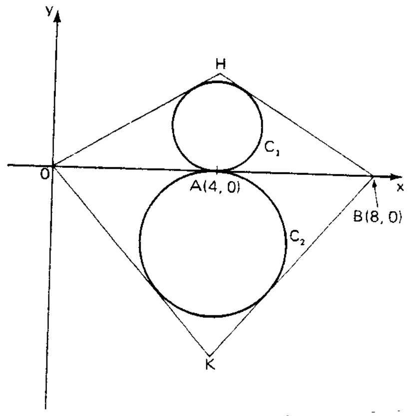
(b) Find the values of m such that
(i) L meets C at two distinct points,
(ii) L is a tangent to C,
(iii) L does not meet C.

(c) For the two tangents in (b) (ii), let the corresponding points of contact be P and Q. Find the equation of PQ.

23. (a) C is a circle with $(0, 1)$ and (p, q) as ends of a diameter. If C cuts the x-axis at two points $(\alpha, 0)$ and $(\beta, 0)$, express $\alpha + \beta$ and $\alpha\beta$ in terms of p and q.

(b) By drawing a suitable circle, solve the quadratic equation $x^2 + 3x + 1 = 0$.

24. In the figure, A and B are the points $(4, 0)$ and $(8, 0)$ respectively. The equation of C_1 is $x^2 + y^2 - 8x - 2y + 16 = 0$. OH and BH are tangents to C_1.

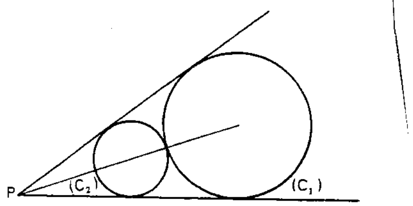


(a) (i) Show that C_1 touches the x-axis at A.
(ii) Find the equation of OH.
(iii) Find the equation of BH.

(b) In the figure, the equation of OK is $4x + 3y = 0$. The circle
C_2: $x^2 + y^2 - 8x + 2fy + c = 0$
is the inscribed circle of ΔOBK and touches the x-axis at A.
(i) Find the values of the constants c and f.
(ii) Find area of ΔOBH : area of ΔOBK.

25. Given two circles (C_1): $x^2 + y^2 - 24y = 0$,
(C_2): $x^2 + y^2 + 24x - 6y + 144 = 0$.

The two external common tangents to the two circles and the line joining their centres meet at the point P.



(a) Find the coordinates of the centres and the radii of the two circles.

(b) Show that (C_1) and (C_2) touch each other.

(c) Show that the x-axis is a common tangent to the two circles.

(d) (i) Find the coordinates of the point P.
(ii) Find the equation of the other external common tangent to the two circles.

(e) Find the equation of the third common tangent to the two circles.