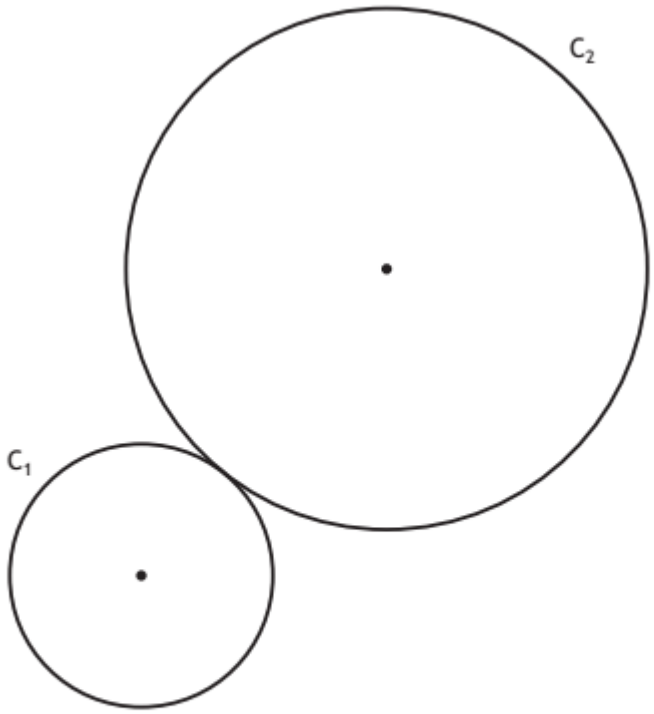
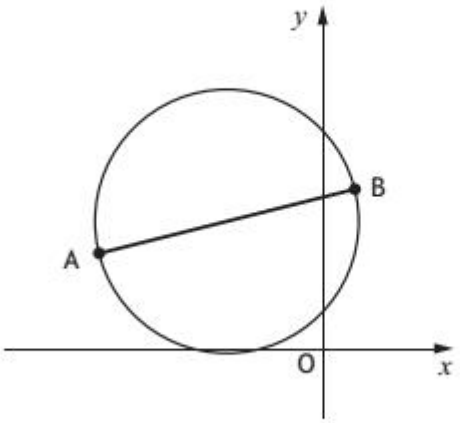
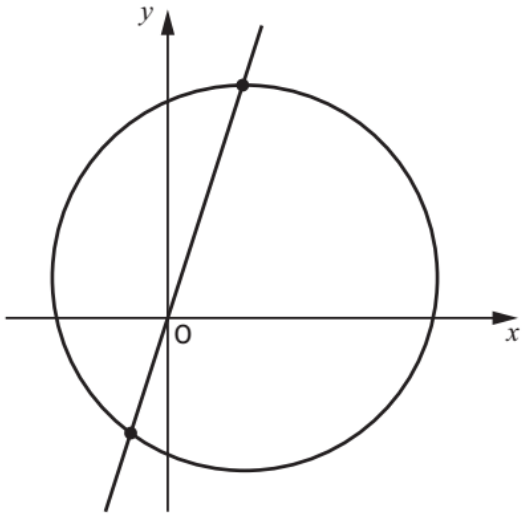
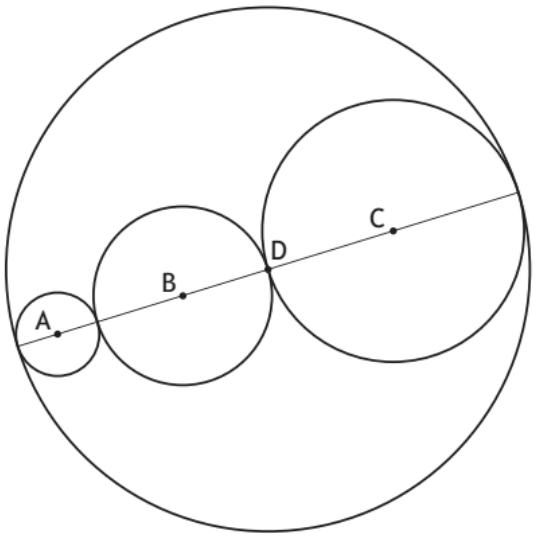
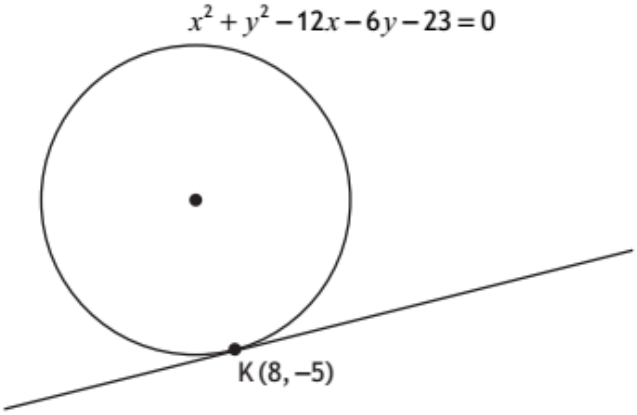
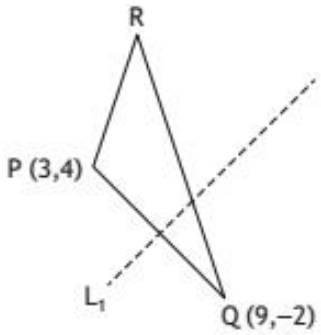
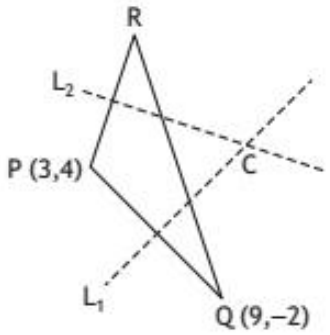
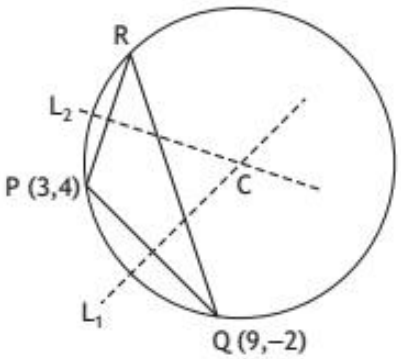
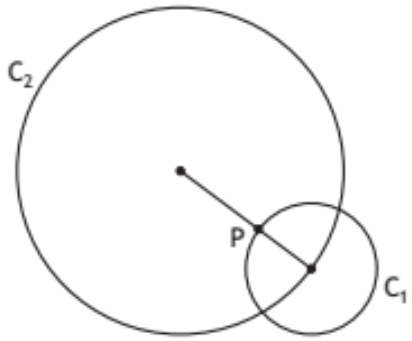
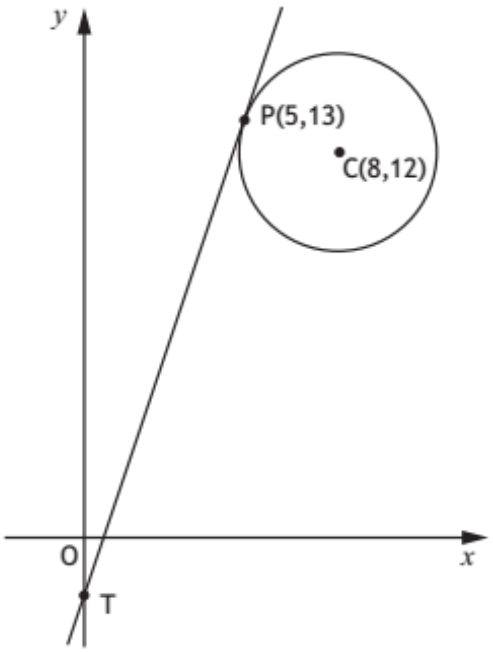
Y	Q	P	CIRCLES
15	11	1	T$(-2, -5)$ lies on the circumference of the circle with equation $(x+8)^2+(y+2)^2=45.$ (a) Find the equation of the tangent to the circle passing through T. **4** (b) This tangent is also a tangent to a parabola with equation $y=-2x^2+px+1-p$, where $p>3$. Determine the value of p. **6**
15	14	1	The circle with equation $x^2+y^2-12x-10y+k=0$ meets the coordinate axes at exactly three points. What is the value of k? **2**
15	5	2	Circle C_1 has equation $x^2+y^2+6x+10y+9=0$. The centre of circle C_2 is $(9, 11)$. Circles C_1 and C_2 touch externally.  (a) Determine the radius of C_2. **4** A third circle, C_3, is drawn such that: • both C_1 and C_2 touch C_3 internally • the centres of C_1, C_2 and C_3 are collinear. (b) Determine the equation of C_3. **4**

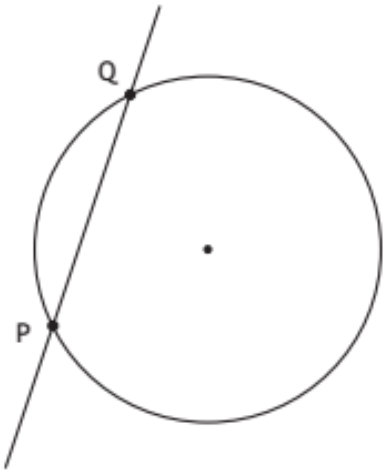
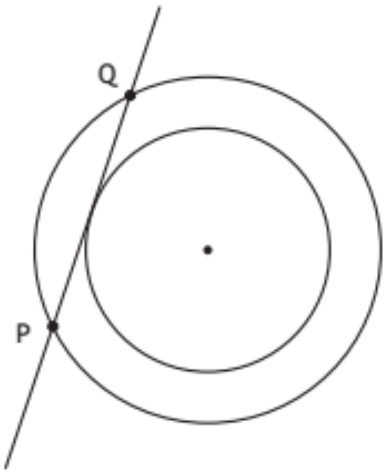
16	4	1	A and B are the points $(-7, 3)$ and $(1, 5)$. AB is a diameter of a circle.  Find the equation of this circle. **3**
16	8	1	Show that the line with equation $y = 3x - 5$ is a tangent to the circle with equation $x^2 + y^2 + 2x - 4y - 5 = 0$ and find the coordinates of the point of contact. **5**
16	4	2	Circles C_1 and C_2 have equations $(x+5)^2 + (y-6)^2 = 9$ and $x^2 + y^2 - 6x - 16 = 0$ respectively. (a) Write down the centres and radii of C_1 and C_2. **4** (b) Show that C_1 and C_2 do not intersect. **3**
17	2	1	The point P (–2, 1) lies on the circle $x^2 + y^2 - 8x - 6y - 15 = 0$. Find the equation of the tangent to the circle at P. **4**
17	3	2	The line $y = 3x$ intersects the circle with equation $(x-2)^2 + (y-1)^2 = 25$.  Find the coordinates of the points of intersection. **5**

17	10	2	(a) Show that the points A(−7, −2), B(2, 1) and C(17, 6) are collinear. **3** Three circles with centres A, B and C are drawn inside a circle with centre D as shown.  The circles with centres A, B and C have radii r_A, r_B and r_C respectively. • $r_A = \sqrt{10}$ • $r_B = 2r_A$ • $r_C = r_A + r_B$ (b) Determine the equation of the circle with centre D. **4**
18	4	1	The point K (8, −5) lies on the circle with equation $x^2 + y^2 - 12x - 6y - 23 = 0$.  Find the equation of the tangent to the circle at K. **4**

18	5	2	PQR is a triangle with P(3,4) and Q(9,–2).  (a) Find the equation of L_1, the perpendicular bisector of PQ. **3** The equation of L_2, the perpendicular bisector of PR is $3y + x = 25$.  (b) Calculate the coordinates of C, the point of intersection of L_1 and L_2. **2** C is the centre of the circle which passes through the vertices of triangle PQR.  (c) Determine the equation of this circle. **2**

18	12	2	Circle C_1 has equation $(x-13)^2+(y+4)^2=100$. Circle C_2 has equation $x^2+y^2+14x-22y+c=0$.  (a) (i) Write down the coordinates of the centre of C_1. **1** (ii) The centre of C_1 lies on the circumference of C_2. Show that $c=-455$. **1** The line joining the centres of the circles intersects C_1 at P. (b) (i) Determine the ratio in which P divides the line joining the centres of the circles. **2** (ii) Hence, or otherwise, determine the coordinates of P. **2** P is the centre of a third circle, C_3. C_2 touches C_3 internally. (c) Determine the equation of C_3. **1**
19	3	1	Circle C_1 has equation $x^2+y^2-6x-2y-26=0$. Circle C_2 has centre $(4,-2)$. The radius of C_2 is equal to the radius of C_1. Find the equation of circle C_2. **2**
19	16	1	The point P has coordinates $(4,k)$. C is the centre of the circle with equation $(x-1)^2+(y+2)^2=25$. (a) Show that the distance between the points P and C is given by $\sqrt{k^2+4k+13}$. **2** (b) Hence, or otherwise, find the range of values of k such that P lies outside the circle. **4**

19	15	2	A circle has centre C(8,12). The point P(5,13) lies on the circle as shown.  (a) Find the equation of the tangent at P. **3** The tangent from P meets the y-axis at the point T. (b) (i) State the coordinates of T. **1** (ii) Find the equation of the circle that passes through the points C, P and T. **3**
22	14	1	C_1 is the circle with equation $(x-7)^2+(y+5)^2=100$. (a) (i) State the centre and radius of C_1. **2** (ii) Hence, or otherwise, show that the point P(−2, 7) lies outside C_1. **2** C_2 is a circle with centre P and radius r. (b) Determine the value(s) of r for which circles C_1 and C_2 have exactly one point of intersection. **2**

22	9	2	The line $y = 3x \quad 7$ intersects the circle $x^2 + y^2 - 4x - 6y - 7 = 0$ at the points P and Q.  (a) Find the coordinates of P and Q. **5** PQ is a tangent to a second, smaller circle. This circle is concentric with the first.  (b) Determine the equation of the smaller circle. **4**