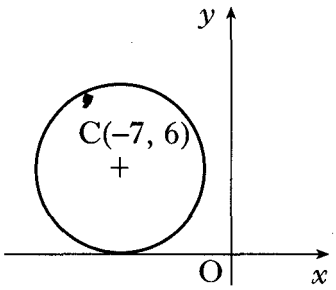
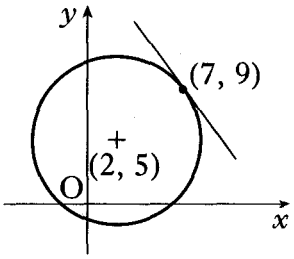
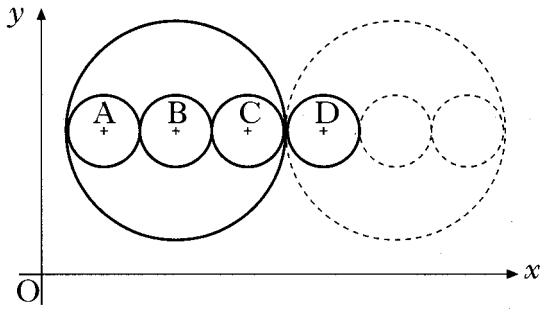
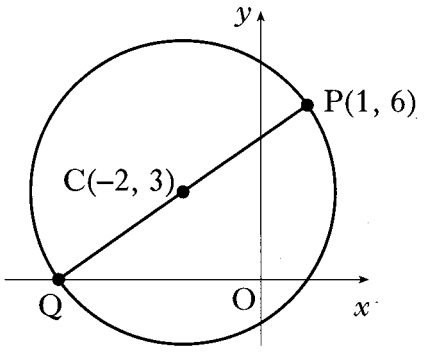
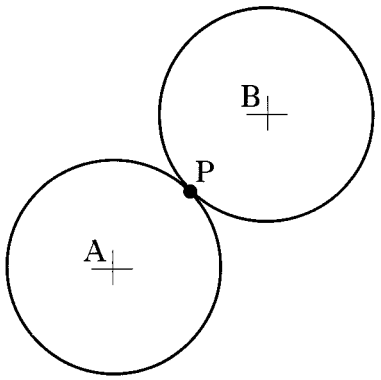
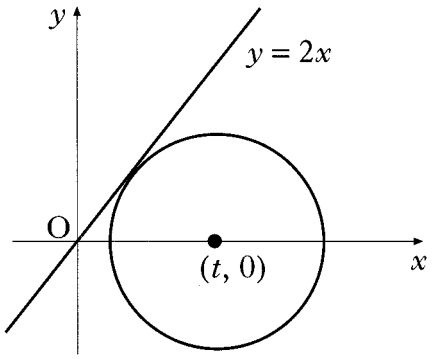
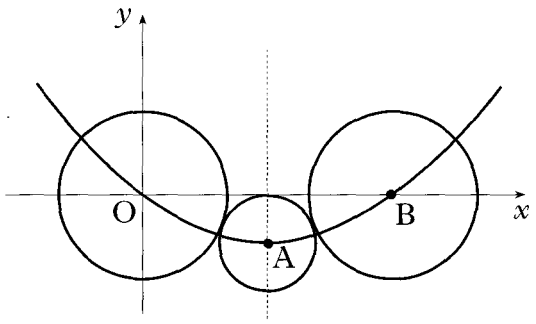
2008 P1	**2.** The x-axis is a tangent to a circle with centre $(-7, 6)$ as shown in the diagram.  What is the equation of the circle? A $(x+7)^2+(y-6)^2=1$ B $(x+7)^2+(y-6)^2=49$ C $(x-7)^2+(y+6)^2=36$ D $(x+7)^2+(y-6)^2=36$	2
Ans	D	
2008 P1	**5.** The diagram shows a circle, centre (2, 5) and a tangent drawn at the point (7, 9). What is the equation of this tangent?  A $y-9=-\frac{5}{4}(x-7)$ B $y+9=-\frac{4}{5}(x+7)$ C $y-7=\frac{4}{5}(x-9)$ D $y+9=\frac{5}{4}(x+7)$	2
Ans	A	

2008 P2	**4.** (*a*) Write down the centre and calculate the radius of the circle with equation $x^2 + y^2 + 8x + 4y - 38 = 0$.	2
	(*b*) A second circle has equation $(x - 4)^2 + (y - 6)^2 = 26$. Find the distance between the centres of these two circles and hence show that the circles intersect.	4
	(*c*) The line with equation $y = 4 - x$ is a common chord passing through the points of intersection of the two circles. Find the coordinates of the points of intersection of the two circles.	5
Ans	(a) (-4,-2), $\sqrt{58}$ (b) d = $\sqrt{128}$ (c) (3,1), (-1,5)	
2007 P1	**5.** The large circle has equation $x^2 + y^2 - 14x - 16y + 77 = 0$. Three congruent circles with centres A, B and C are drawn inside the large circle with the centres lying on a line parallel to the x-axis. This pattern is continued, as shown in the diagram. Find the equation of the circle with centre D. 	5
Ans	$(x - 15)^2 + (y - 8)^2 = 2^2$	
2007 P2	**3.** Show that the line with equation $y = 6 - 2x$ is a tangent to the circle with equation $x^2 + y^2 + 6x - 4y - 7 = 0$ and find the coordinates of the point of contact of the tangent and the circle.	6
Ans	$x^2 + (6 - 2x)^2 + 6x - 4(6 - 2x) - 7 = 0$ $x^2 + 36 - 24x + 4x^2 + 6x - 24 + 8x - 7 = 0$ $5x^2 - 10x + 5 = 0$ $5(x^2 - 1) = 0$ Only one root so line is tangential to circle. Point of contact is (1,4).	
2006 P1	**2.** A circle has centre C(–2, 3) and passes through P(1, 6). (*a*) Find the equation of the circle. (*b*) PQ is a diameter of the circle. Find the equation of the tangent to this circle at Q. 	2 4

Ans	(*a*) $r^2 = 18$ (*b*) $y - 0 = -(x - (-5))$	
2006 P2	**4.** The circles with equations $(x-3)^2 + (y-4)^2 = 25$ and $x^2 + y^2 - kx - 8y - 2k = 0$ have the same centre. Determine the radius of the larger circle.	5
Ans	$\sqrt{37}$, 5 and "2nd" circle	
2005 P1	**2.** Two congruent circles, with centres A and B, touch at P. Relative to suitable axes, their equations are $x^2 + y^2 + 6x + 4y - 12 = 0$ and $x^2 + y^2 - 6x - 12y + 20 = 0$. (*a*) Find the coordinates of P. (*b*) Find the length of AB. 	3 2
Ans	(*a*) P = (0,2) (*b*) AB = 10	
2005 P1	**11.** (*a*) A circle has centre $(t, 0)$, $t > 0$, and radius 2 units. Write down the equation of the circle. (*b*) Find the exact value of t such that the line $y = 2x$ is a tangent to the circle. 	1 5
Ans	.(*a*) $(x-t)^2 + (y-0)^2 = 2^2$ (*b*) $t = \sqrt{5}$	

2003 P1

11. • O, A and B are the centres of the three circles shown in the diagram below.
• The two outer circles are congruent and each touches the smallest circle.
• Circle centre A has equation $(x - 12)^2 + (y + 5)^2 = 25$.
• The three centres lie on a parabola whose axis of symmetry is shown by the broken line through A.



(*a*) (i) State the coordinates of A and find the length of the line OA. 2
(ii) Hence find the equation of the circle with centre B. 3

(*b*) The equation of the parabola can be written in the form $y = px(x + q)$.
Find the values of p and q. 2

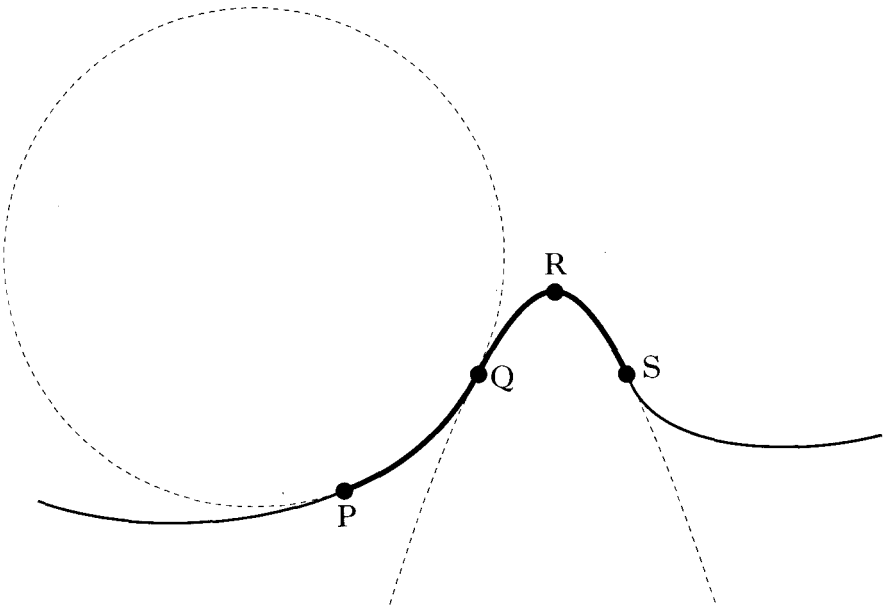
Ans

(*a*) (i) A(12, –5), OA = 13
(ii) $(x - 24)^2 + y^2 = 64$

(*b*) $p = \frac{5}{144}$, $q = -24$

2002W P1

6. The side view of part of a roller coaster ride is shown by the path PQRS.
The curve PQ is an arc of the circle with equation $x^2 + y^2 + 4x - 10y + 9 = 0$.
The curve QRS is part of the parabola with equation $y = -x^2 + 6x - 5$.
The point Q has coordinates (2, 3).



(*a*) Find the equation of the tangent to the circle at Q. 4

(*b*) Show that this tangent to the circle at Q is also the tangent to the parabola at Q. 2

Ans

(*a*) $y - 2x = -1$

(*b*) proof

For parabola

- $\frac{dy}{dx} = -2x + 6$
- $m = 2$

(same as gradient of tangent to circle)

2002W P2

10. The line $y + 2x = k$, $k > 0$, is a tangent to the circle $x^2 + y^2 - 2x - 4 = 0$.

(*a*) Find the value of k. 7

(*b*) Deduce the coordinates of the point of contact. 2

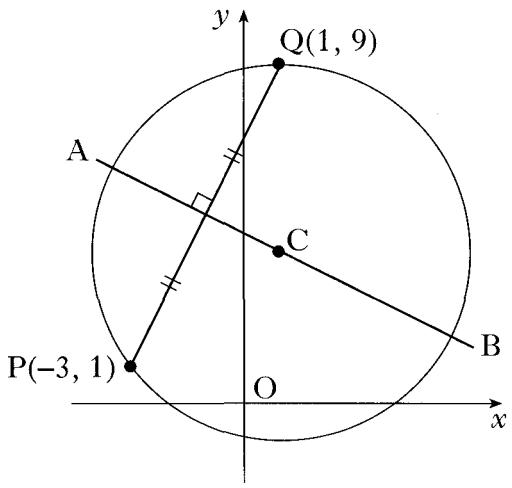
Ans

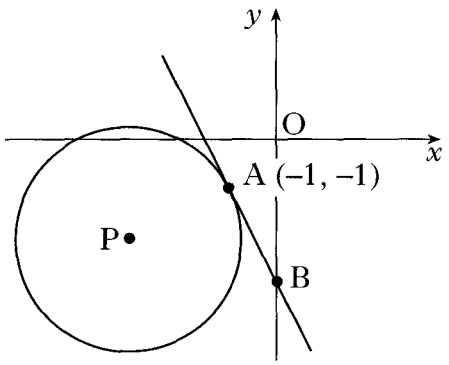
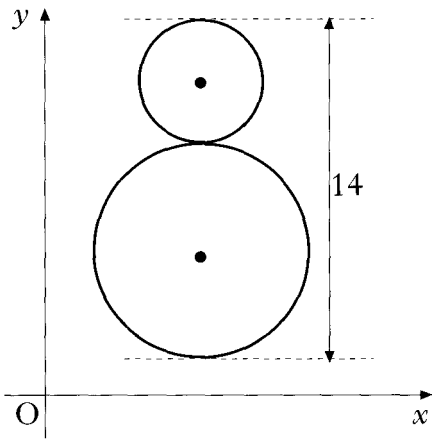
(*a*) $x^2 + (k - 2x)^2 - 2x - 4 = 0$ and apply discriminant

$k=7$

(*b*) (3, 1)

2002 P1	**1.** The point P(2, 3) lies on the circle $(x+1)^2 + (y-1)^2 = 13$. Find the equation of the tangent at P.	4
Ans	$2y + 3x = 12$	
2001 P1	**11.** Circle P has equation $x^2 + y^2 - 8x - 10y + 9 = 0$. Circle Q has centre $(-2, -1)$ and radius $2\sqrt{2}$. (*a*) (i) Show that the radius of circle P is $4\sqrt{2}$. (ii) Hence show that circles P and Q touch. (*b*) Find the equation of the tangent to circle Q at the point $(-4, 1)$. (*c*) The tangent in (*b*) intersects circle P in two points. Find the x-coordinates of the points of intersection, expressing your answers in the form $a \pm b\sqrt{3}$.	4 3 3
Ans	(*a*) $r_P = 4\sqrt{2}$ $r_P + r_Q = 6\sqrt{2}$ $C_P = (4,5)$ $C_PC_Q = \sqrt{6^2 + 6^2} = 6\sqrt{2}$ and "so touch" (*b*) $y = x + 5$ (*c*) $x = 2 \pm 2\sqrt{3}$	
2000 P1	**6.** For what range of values of k does the equation $x^2 + y^2 + 4kx - 2ky - k - 2 = 0$ represent a circle?	5
Ans	for all k	
2000 P2	**2.** (*a*) Find the equation of AB, the perpendicular bisector of the line joining the points P(–3, 1) and Q(1, 9). (*b*) C is the centre of a circle passing through P and Q. Given that QC is parallel to the y-axis, determine the equation of the circle. (*c*) The tangents at P and Q intersect at T. Write down (i) the equation of the tangent at Q (ii) the coordinates of T.	4 3 2



Ans	(*a*) $x + 2y = 9$ (*b*) $(x-1)^2 + (y-4)^2 = 25$ (*c*) (i) $y = 9$ (ii) T = (–9, 9)	
Specimen 2 P1	**5.** (*a*) The diagram shows a circle, centre P, with equation $x^2 + y^2 + 6x + 4y + 8 = 0$. Find the equation of the tangent at the point A (–1, –1) on the circle.  (*b*) The tangent crosses the *y*-axis at B. Find the equation of the circle with AB as diameter.	4 3
Ans	(*a*) P = (–3,–2) $m_{PA} = \frac{1}{2} \Rightarrow m_{tgt} = -2$ $y - 1 = -2(x - (-1))$ (*b*) B = (0,3) centre C = $\text{mid}_{AB} = (-\frac{1}{2}, -2)$ radius^2 = $CB^2 = \frac{5}{4}$ $(x + \frac{1}{2})^2 + (y + 2)^2 = \frac{5}{4}$	
Specimen 1 P1	**6.** A bakery firm makes ginger-bread men each 14 cm high with a circular "head" and "body". The equation of the "body" is $x^2 + y^2 - 10x - 12y + 45 = 0$ and the line of centres is parallel to the *y*-axis. Find the equation of the "head".  	5
Ans	$(x - 5)^2 + (y - 13)^2 = 9$	