

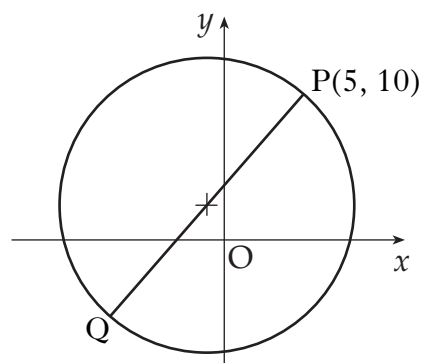
# circles problems

[SQA] 1.

(a) Show that the point  $P(5, 10)$  lies on circle  $C_1$  with equation  $(x + 1)^2 + (y - 2)^2 = 100$ .

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(b)  $PQ$  is a diameter of this circle as shown in the diagram. Find the equation of the tangent at  $Q$ .



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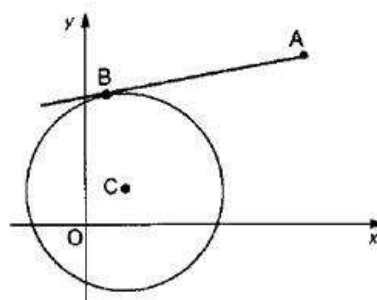
(c) Two circles,  $C_2$  and  $C_3$ , touch circle  $C_1$  at  $Q$ .

The radius of each of these circles is twice the radius of circle  $C_1$ .

Find the equations of circles  $C_2$  and  $C_3$ .

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[SQA] 2.  **$AB$  is a tangent at  $B$  to the circle with centre  $C$  and equation  $(x - 2)^2 + (y - 2)^2 = 25$ .**  
**The point  $A$  has co-ordinates  $(10, 8)$ .**  
**Find the area of triangle  $ABC$ .**



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3. Circle  $C_1$  has equation  $(x + 1)^2 + (y - 1)^2 = 121$ .

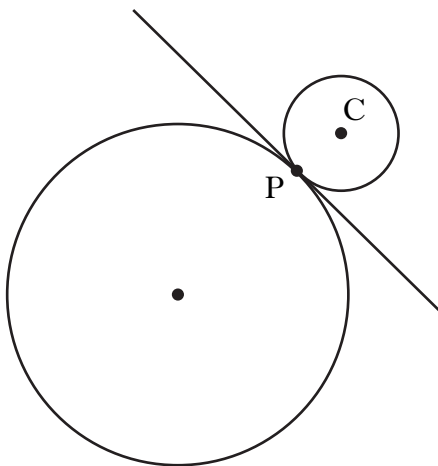
A circle  $C_2$  with equation  $x^2 + y^2 - 4x + 6y + p = 0$  is drawn inside  $C_1$ .

The circles have no points of contact.

What is the range of values of  $p$ ?

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- [SQA] 4. 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. 4
- (b) Find the equation of the tangent to the circle Q at the point  $(-4, 1)$ . 3
- (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  $a \pm b\sqrt{3}$ . 3
5. (a) (i) Show that the line with equation  $y = 3 - x$  is a tangent to the circle with equation  $x^2 + y^2 + 14x + 4y - 19 = 0$ .  
 (ii) Find the coordinates of the points of contact, P. 5
- (b) Relative to a suitable set of coordinate axes, the diagram below shows the circle from (a) and a second smaller circle with centre C.



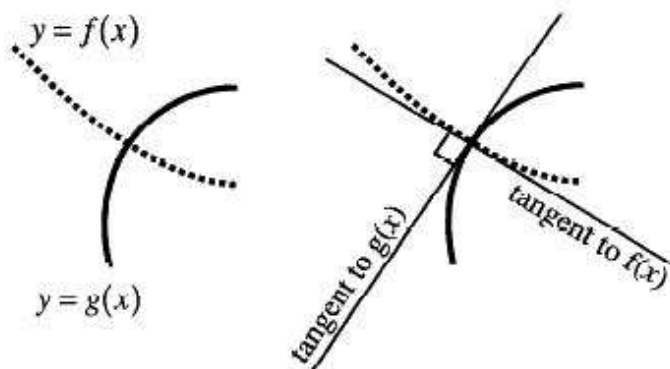
The line  $y = 3 - x$  is a common tangent at the point P.

The radius of the larger circle is three times the radius of the smaller circle.

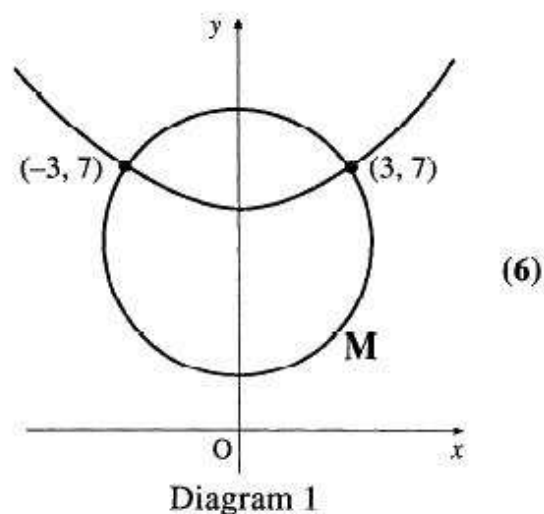
Find the equation of the smaller circle.

[SQA] 6.

Two curves,  $y = f(x)$  and  $y = g(x)$ , are called orthogonal if, at each point of intersection, their tangents are at right angles to each other.



- (a) Diagram 1 shows the parabola with equation  $y = 6 + \frac{1}{9}x^2$  and the circle M with equation  $x^2 + (y - 5)^2 = 13$ . These two curves intersect at  $(3, 7)$  and  $(-3, 7)$ . Prove that these curves are orthogonal.



- (b) Diagram 2 shows the circle M, from (a) above, which is orthogonal to the circle N. The circles intersect at  $(3, 7)$  and  $(-3, 7)$ .
- Write down the equation of the tangent to circle M at the point  $(-3, 7)$ .
  - Hence find the equation of circle N.

