1

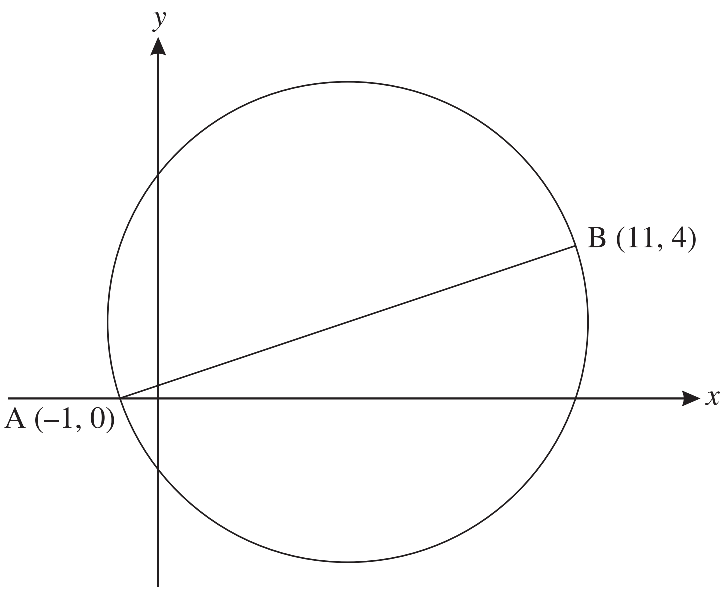


Fig. 11

Fig. 11 shows the points A and B, which have coordinates $(-1, 0)$ and $(11, 4)$ respectively.

(i) Show that the equation of the circle with AB as diameter may be written as

$$(x-5)^2 + (y-2)^2 = 40.$$ **[4]**

(ii) Find the coordinates of the points of intersection of this circle with the y-axis. Give your answer in the form $a \pm \sqrt{b}$. **[4]**

(iii) Find the equation of the tangent to the circle at B. Hence find the coordinates of the points of intersection of this tangent with the axes. **[6]**

2 A circle has equation $x^2 + y^2 - 8x - 4y = 9$.

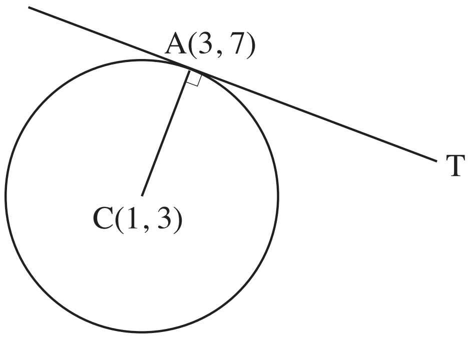
(i) Show that the centre of this circle is C (4, 2) and find the radius of the circle. [3]

(ii) Show that the origin lies inside the circle. [2]

(iii) Show that AB is a diameter of the circle, where A has coordinates (2, 7) and B has coordinates (6, −3). [4]

(iv) Find the equation of the tangent to the circle at A. Give your answer in the form $y = mx + c$. [4]

3



Not to scale

Fig. 11

A circle has centre C(1, 3) and passes through the point A(3, 7) as shown in Fig. 11.

(i) Show that the equation of the tangent at A is $x + 2y = 17$. [4]

(ii) The line with equation $y = 2x - 9$ intersects this tangent at the point T.

Find the coordinates of T. [3]

(iii) The equation of the circle is $(x - 1)^2 + (y - 3)^2 = 20$.

Show that the line with equation $y = 2x - 9$ is a tangent to the circle. Give the coordinates of the point where this tangent touches the circle. [5]

4 There is an insert for use in this question.

The graph of $y = x + \frac{1}{x}$ is shown on the insert. The lowest point on one branch is $(1, 2)$. The highest point on the other branch is $(-1, -2)$.

(i) Use the graph to solve the following equations, showing your method clearly.

(A) $x + \frac{1}{x} = 4$ [2]

(B) $2x + \frac{1}{x} = 4$ [4]

(ii) The equation $(x-1)^2 + y^2 = 4$ represents a circle. Find in exact form the coordinates of the points of intersection of this circle with the y-axis. [2]

(iii) State the radius and the coordinates of the centre of this circle.

Explain how these can be used to deduce from the graph that this circle touches one branch of the curve $y = x + \frac{1}{x}$ but does not intersect with the other. [4]