

# Circles

The points  $A$  and  $B$  have coordinates  $(5, -1)$  and  $(13, 11)$  respectively.

(a) Find the coordinates of the mid-point of  $AB$ .

(2)

Given that  $AB$  is a diameter of the circle  $C$ ,

(b) find an equation for  $C$ .

(4)

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The circle  $C$ , with centre at the point  $A$ , has equation  $x^2 + y^2 - 10x + 9 = 0$ .

Find

(a) the coordinates of  $A$ ,

(2)

(b) the radius of  $C$ ,

(2)

(c) the coordinates of the points at which  $C$  crosses the  $x$ -axis.

(2)

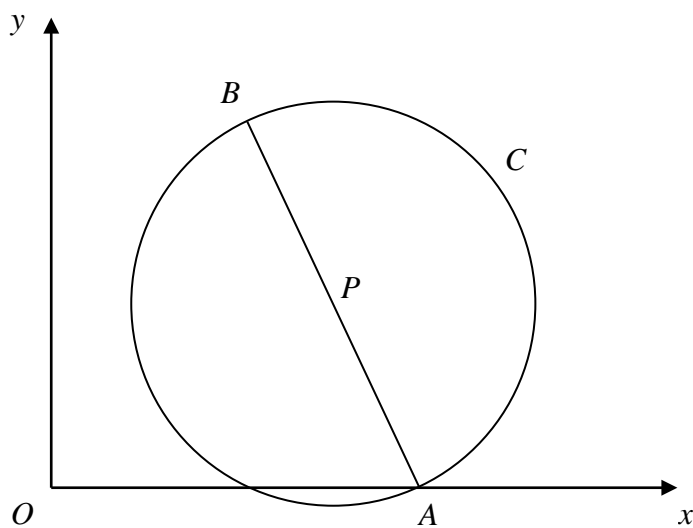
Given that the line  $l$  with gradient  $\frac{7}{2}$  is a tangent to  $C$ , and that  $l$  touches  $C$  at the point  $T$ ,

(d) find an equation of the line which passes through  $A$  and  $T$ .

(3)

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**Figure 1**



In Figure 1,  $A(4, 0)$  and  $B(3, 5)$  are the end points of a diameter of the circle  $C$ .

Find

(a) the exact length of  $AB$ ,

(2)

(b) the coordinates of the midpoint  $P$  of  $AB$ ,

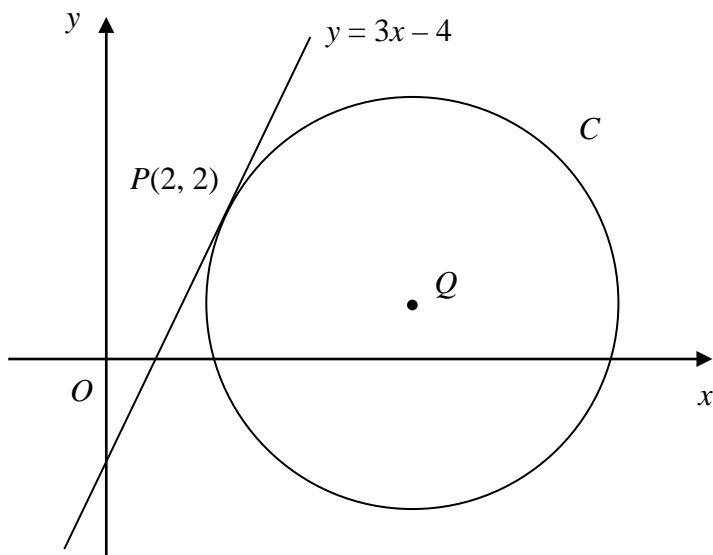
(2)

(c) an equation for the circle  $C$ .

(3)

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**Figure 1**



The line  $y = 3x - 4$  is a tangent to the circle  $C$ , touching  $C$  at the point  $P(2, 2)$ , as shown in Figure 1.

The point  $Q$  is the centre of  $C$ .

(a) Find an equation of the straight line through  $P$  and  $Q$ .

(3)

Given that  $Q$  lies on the line  $y = 1$ ,

(b) show that the  $x$ -coordinate of  $Q$  is 5,

(1)

(c) find an equation for  $C$ .

(4)

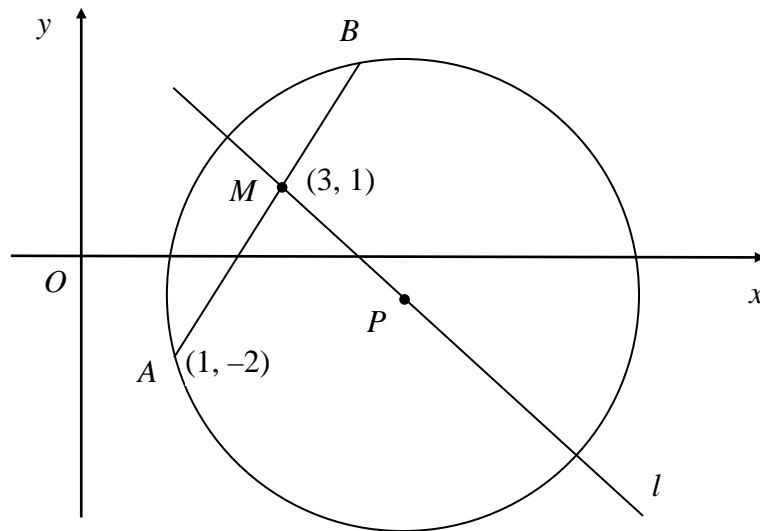
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The line joining points  $(-1, 4)$  and  $(3, 6)$  is a diameter of the circle  $C$ .

Find an equation for  $C$ .

(6)

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**Figure 3**

The points  $A$  and  $B$  lie on a circle with centre  $P$ , as shown in Figure 3. The point  $A$  has coordinates  $(1, -2)$  and the mid-point  $M$  of  $AB$  has coordinates  $(3, 1)$ . The line  $l$  passes through the points  $M$  and  $P$ .

(a) Find an equation for  $l$ .

**(4)**

Given that the  $x$ -coordinate of  $P$  is 6,

(b) use your answer to part (a) to show that the  $y$ -coordinate of  $P$  is  $-1$ ,

**(1)**

(c) find an equation for the circle.

**(4)**

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A circle  $C$  has centre  $M(6, 4)$  and radius 3.

(a) Write down the equation of the circle in the form

$$(x - a)^2 + (y - b)^2 = r^2. \quad (2)$$

**Figure 3**

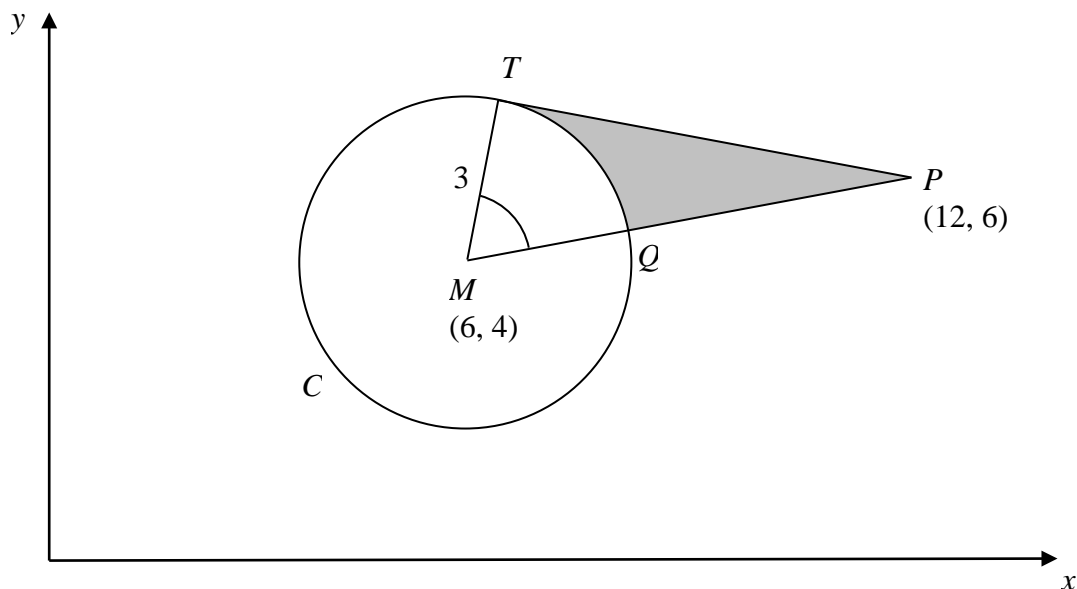


Figure 3 shows the circle  $C$ . The point  $T$  lies on the circle and the tangent at  $T$  passes through the point  $P(12, 6)$ . The line  $MP$  cuts the circle at  $Q$ .

(b) Show that the angle  $TMQ$  is 1.0766 radians to 4 decimal places. (4)

The shaded region  $TPQ$  is bounded by the straight lines  $TP$ ,  $QP$  and the arc  $TQ$ , as shown in Figure 3.

(c) Find the area of the shaded region  $TPQ$ . Give your answer to 3 decimal places. (5)

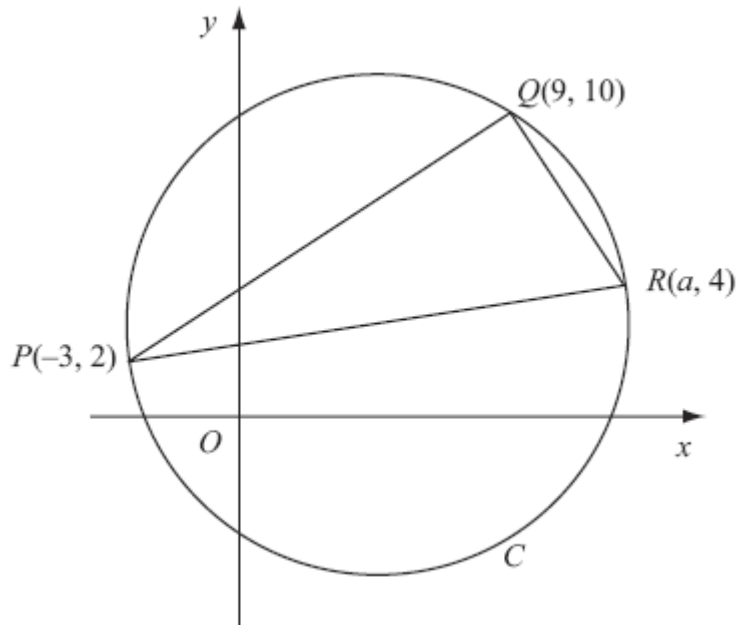
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The circle  $C$  has centre  $(3, 1)$  and passes through the point  $P(8, 3)$ .

(a) Find an equation for  $C$ . (4)

(b) Find an equation for the tangent to  $C$  at  $P$ , giving your answer in the form  $ax + by + c = 0$ , where  $a$ ,  $b$  and  $c$  are integers. (5)

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**Figure 2**

The points  $P(-3, 2)$ ,  $Q(9, 10)$  and  $R(a, 4)$  lie on the circle  $C$ , as shown in Figure 2.

Given that  $PR$  is a diameter of  $C$ ,

(a) show that  $a = 13$ ,

**(3)**

(b) find an equation for  $C$ .

**(5)**

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The circle  $C$  has equation

$$x^2 + y^2 - 6x + 4y = 12$$

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

**(5)**

The point  $P(-1, 1)$  and the point  $Q(7, -5)$  both lie on  $C$ .

(b) Show that  $PQ$  is a diameter of  $C$ .

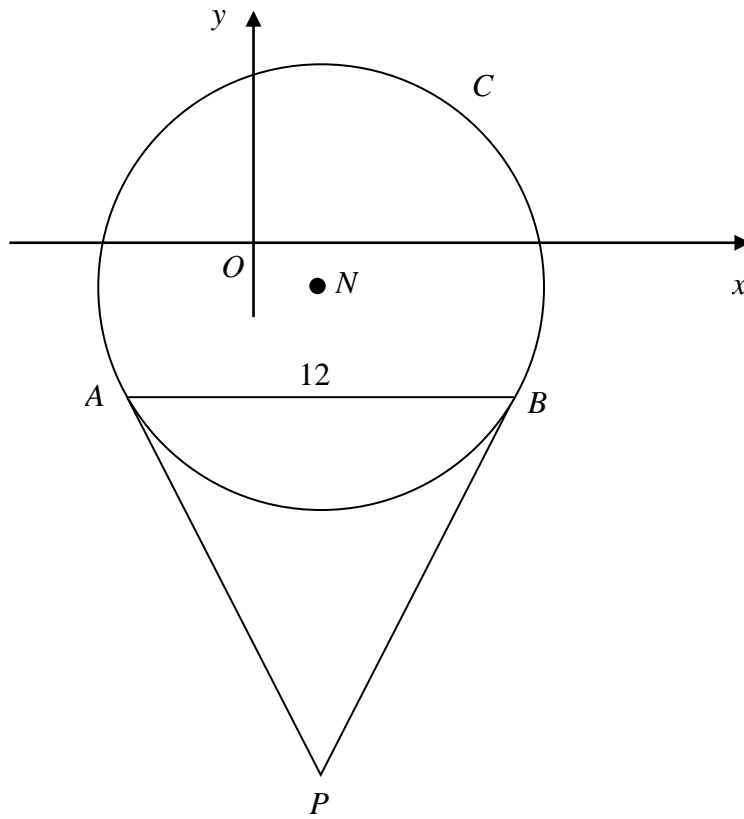
**(2)**

The point  $R$  lies on the positive  $y$ -axis and the angle  $PRQ = 90^\circ$ .

(c) Find the coordinates of  $R$ .

**(4)**

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**Figure 3**

Figure 3 shows a sketch of the circle  $C$  with centre  $N$  and equation

$$(x - 2)^2 + (y + 1)^2 = \frac{169}{4}.$$

(a) Write down the coordinates of  $N$ . (2)

(b) Find the radius of  $C$ . (1)

The chord  $AB$  of  $C$  is parallel to the  $x$ -axis, lies below the  $x$ -axis and is of length 12 units as shown in Figure 3.

(c) Find the coordinates of  $A$  and the coordinates of  $B$ . (5)

(d) Show that angle  $ANB = 134.8^\circ$ , to the nearest 0.1 of a degree. (2)

The tangents to  $C$  at the points  $A$  and  $B$  meet at the point  $P$ .

(e) Find the length  $AP$ , giving your answer to 3 significant figures. (2)

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The circle  $C$  has centre  $A(2,1)$  and passes through the point  $B(10, 7)$  .

(a) Find an equation for  $C$ .

(4)

The line  $l_1$  is the tangent to  $C$  at the point  $B$ .

(b) Find an equation for  $l_1$  .

(4)

The line  $l_2$  is parallel to  $l_1$  and passes through the mid-point of  $AB$ .

Given that  $l_2$  intersects  $C$  at the points  $P$  and  $Q$ ,

(c) find the length of  $PQ$ , giving your answer in its simplest surd form.

(3)

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The points  $A$  and  $B$  have coordinates  $(-2, 11)$  and  $(8, 1)$  respectively.

Given that  $AB$  is a diameter of the circle  $C$ ,

(a) show that the centre of  $C$  has coordinates  $(3, 6)$ ,

(1)

(b) find an equation for  $C$ .

(4)

(c) Verify that the point  $(10, 7)$  lies on  $C$ .

(1)

(d) Find an equation of the tangent to  $C$  at the point  $(10, 7)$ , giving your answer in the form  $y = mx + c$ , where  $m$  and  $c$  are constants.

(4)

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The circle  $C$  has equation

$$x^2 + y^2 + 4x - 2y - 11 = 0.$$

Find

(a) the coordinates of the centre of  $C$ ,

(2)

(b) the radius of  $C$ ,

(2)

(c) the coordinates of the points where  $C$  crosses the  $y$ -axis, giving your answers as simplified surds.

(4)

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The circle  $C$ , with centre  $A$ , has equation

$$x^2 + y^2 - 6x + 4y - 12 = 0.$$

(a) Find the coordinates of  $A$ .

**(2)**

(b) Show that the radius of  $C$  is 5.

**(2)**

The points  $P$ ,  $Q$  and  $R$  lie on  $C$ . The length of  $PQ$  is 10 and the length of  $PR$  is 3.

(c) Find the length of  $QR$ , giving your answer to 1 decimal place.

**(3)**