

# Circles- Questions

June 2018 Mathematics Advanced Paper 1: Pure Mathematics 1

1.

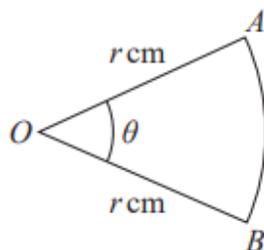


Figure 1

Figure 1 shows a sector  $AOB$  of a circle with centre  $O$  and radius  $r$  cm.

The angle  $AOB$  is  $\theta$  radians.

The area of the sector  $AOB$  is  $11 \text{ cm}^2$

Given that the perimeter of the sector is 4 times the length of the arc  $AB$ , find the exact value of  $r$ .

(4)

2.

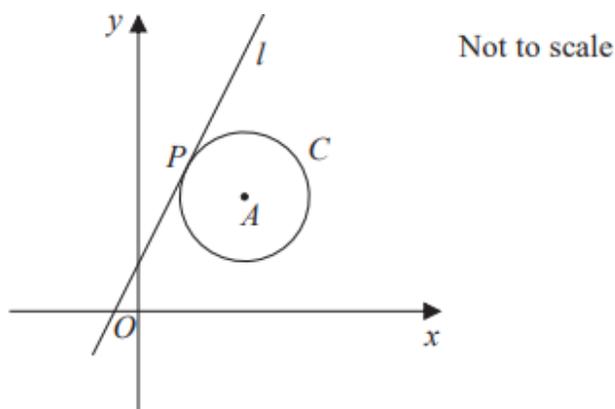


Figure 3

The circle  $C$  has centre  $A$  with coordinates  $(7, 5)$ .

The line  $l$ , with equation  $y = 2x + 1$ , is the tangent to  $C$  at the point  $P$ , as shown in Figure 3.

(a) Show that an equation of the line  $PA$  is  $2y + x = 17$

(3)

(b) Find an equation for  $C$ .

(4)

The line with equation  $y = 2x + k$ ,  $k \neq 1$  is also a tangent to  $C$ .

(c) Find the value of the constant  $k$ .

(3)

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3.

A circle  $C$  has equation

$$x^2 + y^2 - 4x + 8y - 8 = 0$$

(a) Find

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

(ii) the exact radius of  $C$ .

(3)

The straight line with equation  $x = k$ , where  $k$  is a constant, is a tangent to  $C$ .

(b) Find the possible values for  $k$ .

(2)

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4.

The circle  $C$  has equation

$$x^2 + y^2 - 6x + 10y + 9 = 0$$

(a) Find

(i) the coordinates of the centre of  $C$

(ii) the radius of  $C$

(3)

The line with equation  $y = kx$ , where  $k$  is a constant, cuts  $C$  at two distinct points.

(b) Find the range of values for  $k$ .

(6)

5.

5. The circle  $C$  has equation

$$x^2 + y^2 - 10x + 6y + 30 = 0$$

Find

- (a) the coordinates of the centre of  $C$ , (2)
- (b) the radius of  $C$ , (2)
- (c) the  $y$  coordinates of the points where the circle  $C$  crosses the line with equation  $x = 4$ , giving your answers as simplified surds. (3)

6.

2. A circle  $C$  with centre at the point  $(2, -1)$  passes through the point  $A$  at  $(4, -5)$ .

- (a) Find an equation for the circle  $C$ . (3)
- (b) Find an equation of the tangent to the circle  $C$  at the point  $A$ , giving your answer in the form  $ax + by + c = 0$ , where  $a$ ,  $b$  and  $c$  are integers. (4)

7.

9.

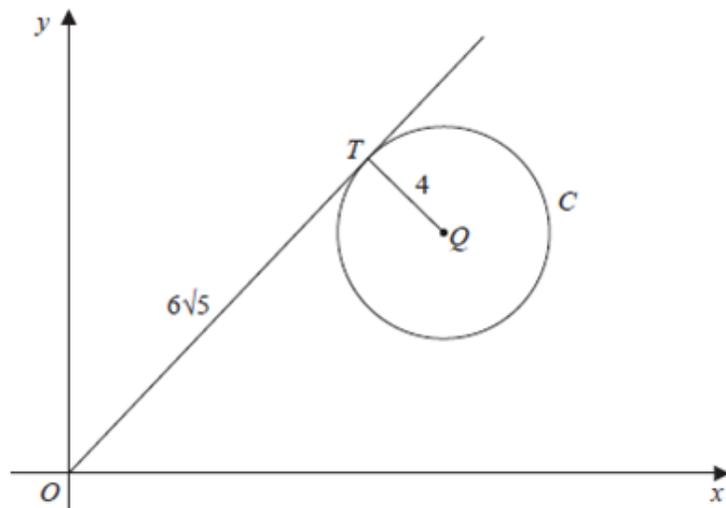


Figure 3

Figure 3 shows a circle  $C$  with centre  $Q$  and radius 4 and the point  $T$  which lies on  $C$ . The tangent to  $C$  at the point  $T$  passes through the origin  $O$  and  $OT = 6\sqrt{5}$ .

Given that the coordinates of  $Q$  are  $(11, k)$ , where  $k$  is a positive constant,

(a) find the exact value of  $k$ , (3)

(b) find an equation for  $C$ . (2)

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8.

10.

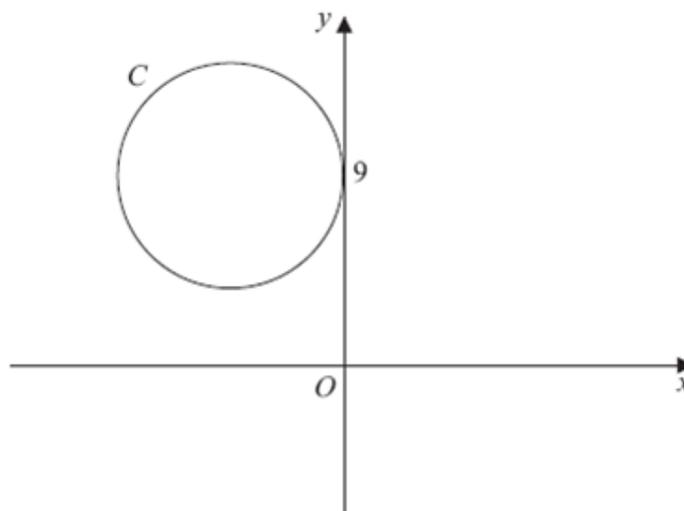


Figure 4

The circle  $C$  has radius 5 and touches the  $y$ -axis at the point  $(0, 9)$ , as shown in Figure 4.

(a) Write down an equation for the circle  $C$ , that is shown in Figure 4. (3)

A line through the point  $P(8, -7)$  is a tangent to the circle  $C$  at the point  $T$ .

(b) Find the length of  $PT$ . (3)

9.

5. The circle  $C$  has equation

$$x^2 + y^2 - 20x - 24y + 195 = 0.$$

The centre of  $C$  is at the point  $M$ .

(a) Find

(i) the coordinates of the point  $M$ ,

(ii) the radius of the circle  $C$ .

(5)

$N$  is the point with coordinates  $(25, 32)$ .

(b) Find the length of the line  $MN$ .

(2)

The tangent to  $C$  at a point  $P$  on the circle passes through point  $N$ .

(c) Find the length of the line  $NP$ .

(2)

10.

3.

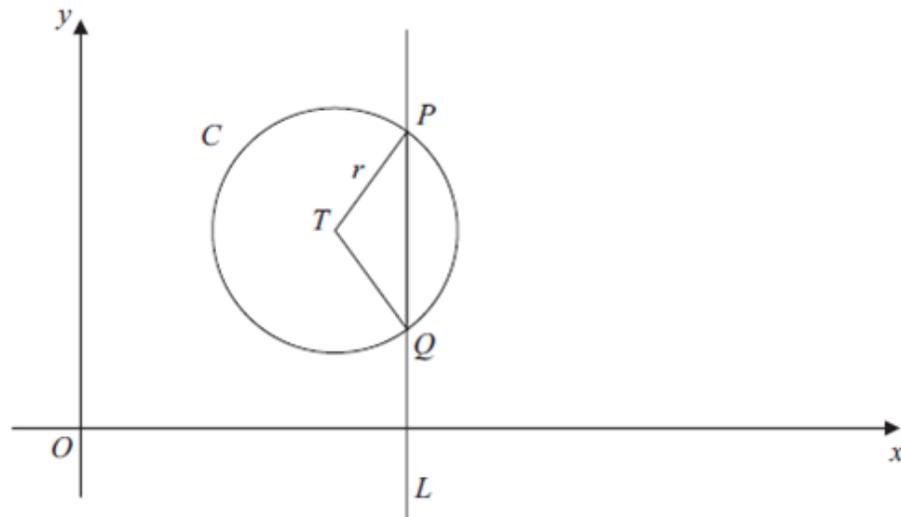


Figure 1

The circle  $C$  with centre  $T$  and radius  $r$  has equation

$$x^2 + y^2 - 20x - 16y + 139 = 0.$$

The circle  $C$  with centre  $T$  and radius  $r$  has equation

$$x^2 + y^2 - 20x - 16y + 139 = 0.$$

(a) Find the coordinates of the centre of  $C$ .

(3)

(b) Show that  $r = 5$

(2)

The line  $L$  has equation  $x = 13$  and crosses  $C$  at the points  $P$  and  $Q$  as shown in Figure 1.

(c) Find the  $y$  coordinate of  $P$  and the  $y$  coordinate of  $Q$ .

(3)

Given that, to 3 decimal places, the angle  $PTQ$  is 1.855 radians,

(d) find the perimeter of the sector  $PTQ$ .

(3)

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11.

2. A circle  $C$  has centre  $(-1, 7)$  and passes through the point  $(0, 0)$ . Find an equation for  $C$ .

(4)

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12.

4. 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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13.

9. 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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14.

10. 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  $B$ .

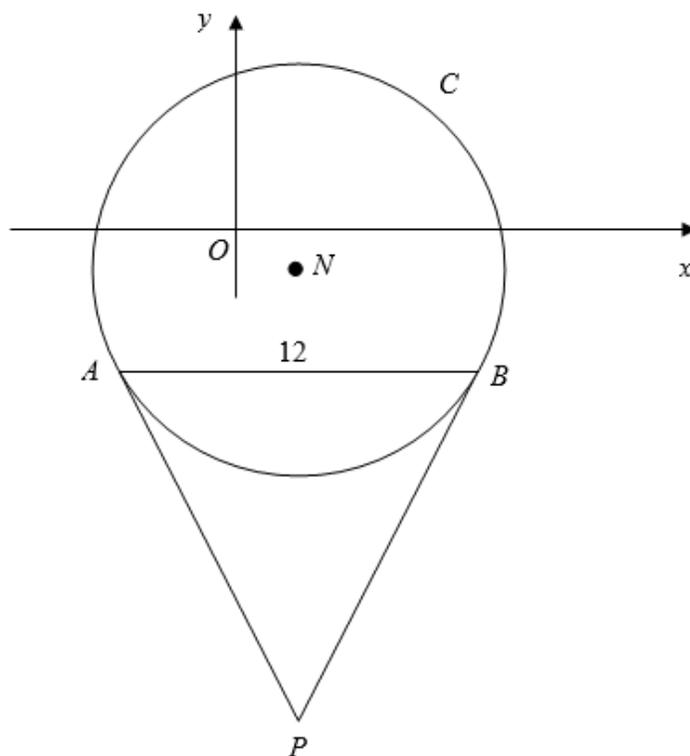
(b) Find an equation for  $l_1$ . (4)

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)

15.  
8.



**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)