

Old Exam Questions – Old Course
Equation of a Circle

(C2 Winter 2005)

6. The circles C_1 and C_2 are given

by $(x + 1)^2 + (y + 2)^2 = 25$

and $x^2 + y^2 - 10x - 5y + 25 = 0$, respectively.

(a) Write down the radius and the coordinates of the centre of C_1 . [2]

(b) Find the radius and the coordinates of the centre of C_2 . [3]

(c) Show that C_1 and C_2 touch. [3]

(C2 Summer 2005)

5. The circle C is given by the equation

$$x^2 + y^2 - 8x + 4y - 5 = 0.$$

(a) Find the radius and the coordinates of the centre of C . [3]

(b) (i) Show that $P(1, -6)$ lies on C . [1]

(ii) Find the equation of the tangent to C at P . [4]

(C2 Winter 2006)

8. (a) Find the centre and radius of the circle C given by

$$x^2 + y^2 - 8x + 4y + 11 = 0. \quad [3]$$

(b) Given that the circle

$$x^2 + y^2 = a^2 \quad (a > 0)$$

touches C externally, find the value of a , giving your answer correct to two decimal places. [4]

(C2 Summer 2006)

9. A circle C has centre D and equation

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

- (a) Find the coordinates of D and the radius of C . [3]
- (b) A line is drawn through the point $P(4, 6)$ so that it touches the circle C at the point T .
- (i) Show that $PT = \sqrt{20}$.
- (ii) Find the equation of the circle centre P which passes through the point T . [5]

(C2 Winter 2007)

5. A circle C_1 with centre A has equation

$$x^2 + y^2 - 6x + 8y - 75 = 0.$$

- (a) Find the coordinates of A and the radius of C_1 . [3]
- (b) A second circle C_2 has centre $B(-6, 8)$ and radius 5.
- (i) Show that C_1 and C_2 touch.
- (ii) Given that the circles touch at the point $P(-3, 4)$, find the equation of the common tangent. [7]

(C2 Summer 2007)

8. The circle $x^2 + y^2 + 4x - 16y + 18 = 0$ has centre A and radius r .

- (a) Find the coordinates of A and the value of r . [3]
- (b) The line $y = x + 2$ and the circle $x^2 + y^2 + 4x - 16y + 18 = 0$ intersect at the points B and C . Find the coordinates of B and C . [4]

(C2 Winter 2008)

8. The circle C has centre A and equation

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

- (a) Find the coordinates of A and the radius of C . [3]
- (b) The point P has coordinates $(5, 1)$ and lies on C . Find the equation of the tangent to C at P . [4]
- (c) The line L has equation $y = x + 3$. Show that L and C do not intersect. [4]

(C2 Summer 2008)

8. The circle C has centre A and radius r . The points $P(1, -4)$ and $Q(9, 10)$ are at either end of a diameter of C .
- (a) (i) Write down the coordinates of A .
 (ii) Show that $r = \sqrt{65}$.
 (iii) Write down the equation of C . [4]
- (b) Verify that the point $R(4, 11)$ lies on C . [2]
- (c) Find \widehat{QPR} . [3]

(C2 Winter 2009)

8. The circle C_1 has centre A and equation

$$x^2 + y^2 + 4x - 2y - 20 = 0.$$

- (a) Find the coordinates of A and the radius of C_1 . [3]
- (b) The line L has equation $y = -x + 6$. Find the coordinates of the points of intersection of L and C_1 . [4]
- (c) The circle C_2 has centre $(10, 6)$ and radius r . Given that C_1 and C_2 touch externally, find the value of r . [3]

(C2 Summer 2009)

8. The circle C_1 has centre A and equation

$$x^2 + y^2 - 6x + 2y - 15 = 0.$$

- (a) Find the coordinates of A and the radius of C_1 . [3]
- (b) The point P has coordinates $(7, 2)$ and lies on C_1 . Find the equation of the tangent to C_1 at P . [4]
- (c) The circle C_2 has centre $B(11, 14)$ and radius 8. A point Q lies on C_1 and a point R lies on C_2 . Find the shortest possible length of the line QR . [3]

(C2 Winter 2010)

8. The circle C has centre A and equation

$$x^2 + y^2 + 4x - 8y + 10 = 0.$$

- (a) Find the coordinates of A and the radius of C . [3]
- (b) The line L has equation

$$x - 3y + 4 = 0.$$

Show that L is a tangent to the circle C . [4]

(C2 Summer 2010)

9. The circle C has centre A and equation

$$x^2 + y^2 - 8x + 2y + 7 = 0.$$

- (a) Find the coordinates of A and the radius of C . [3]
- (b) The point P has coordinates $(7, -2)$.
- (i) Verify that P lies on C .
- (ii) Given that the point Q is such that PQ is a diameter of C , find the coordinates of Q . [4]
- (c) The line L has equation $y = 2x - 4$. Find the coordinates of the points of intersection of L and C . [4]

(C2 Winter 2011)

8. The circle C has centre A and equation

$$x^2 + y^2 - 2x + 6y - 15 = 0.$$

- (a) (i) Write down the coordinates of A .
- (ii) The point P has coordinates $(4, -7)$ and lies on C . Find the equation of the tangent to C at P . [5]
- (b) The line L has equation $y = x + 4$. Show that L and C do not intersect. [4]

(C2 Summer 2011)

8. The circle C_1 has centre A and equation

$$x^2 + y^2 - 4x + 2y - 20 = 0.$$

- (a) Find the coordinates of A and the radius of C_1 . [3]
- (b) A second circle C_2 has centre $B(8, -9)$ and radius 15.
- (i) Show that C_1 and C_2 touch, justifying your answer.
- (ii) Given that the circles touch at the point $P(-1, 3)$, find the equation of the common tangent. [7]

(C2 Winter 2012)

8. The circle C has centre A and radius r . The points $P(3, -8)$ and $Q(5, 6)$ are at either end of a diameter of C .

- (a) (i) Write down the coordinates of A .
- (ii) Show that $r = \sqrt{50}$.
- (iii) Write down the equation of C . [4]
- (b) Verify that the point $R(9, -6)$ lies on C . [2]
- (c) Find \widehat{PQR} . [3]

(C2 Summer 2012)

8. The circle C has centre A and equation

$$x^2 + y^2 - 4x + 6y + 1 = 0.$$

- (a) Find the coordinates of A and the radius of C . [3]
- (b) The point R lies on the circle C . The tangent to the circle at R passes through the point $T(8, 2)$. Find the length of RT . [3]

(C2 Winter 2013)

8. The circle C has centre A and equation

$$x^2 + y^2 + 6x - 10y + 14 = 0.$$

- (a) (i) Find the coordinates of A and the radius of C .
- (ii) The point P has coordinates $(-6, 2)$. Determine whether P lies inside C , on C or outside C . [5]

- (b) The line L has equation

$$y = 2x + 1.$$

- (i) Show that L is a tangent to the circle C and find the coordinates of Q , the point of contact of L and C .
- (ii) The point R has coordinates $(4, 9)$ and R lies on L . Find \widehat{ARQ} . [8]

(C2 Summer 2013)

8. The circle C_1 has centre A and equation

$$x^2 + y^2 + 2x - 6y - 15 = 0.$$

- (a) Find the coordinates of A and the radius of C_1 . [3]
- (b) The line L has equation $y = -x + 9$.
- (i) Show that L is not a diameter of C_1 .
- (ii) Find the coordinates of the points of intersection of L and C_1 . [5]
- (c) The circle C_2 has centre $B(11, 8)$ and radius 6. Find the shortest distance between the circles C_1 and C_2 . [3]

(C2 Winter 2014)

8. The circle C has centre A and equation

$$x^2 + y^2 - 4x + 8y - 5 = 0.$$

- (a) (i) Write down the coordinates of A .
- (ii) The point P has coordinates $(6, -7)$ and lies on C . Find the equation of the tangent to C at P . [5]
- (b) The line L has equation $y = x + 3$. Show that L and C do not intersect. [4]

(C2 Summer 2014)

8. (a) The circle C_1 has centre $A(-2, 9)$ and radius 5. The circle C_2 has centre $B(10, -7)$ and radius 15.

- (i) Show that C_1 and C_2 touch, justifying your answer.
- (ii) Given that the circles touch at the point $P(1, 5)$, find the equation of the common tangent at P . [7]

- (b) Gareth, who has been asked by his teacher to investigate the properties of another circle C_3 , claims that the equation of this circle C_3 is given by

$$x^2 + y^2 + 4x - 6y + 20 = 0.$$

Show that Gareth cannot possibly be correct. [3]

(C2 Summer 2015)

8. The circle C has centre A and radius r . The points $P(-2, -3)$ and $Q(8, 1)$ are at opposite ends of a diameter of C .

- (a) (i) Write down the coordinates of A .
- (ii) Show that $r = \sqrt{29}$. [3]

- (b) Given that the point $R(5, 4)$ lies on the circle C , find \widehat{PQR} . Give your answer in degrees, correct to one decimal place. [3]

- (c) The point S lies on the circle C . The tangent to the circle at S passes through the point $T(11, 0)$. Find the length of ST . [3]

(C2 Summer 2016)

8. The circle C_1 has centre A and equation

$$x^2 + y^2 + 6x - 20y + 59 = 0.$$

- (a) (i) Find the coordinates of A and the radius of C_1 .
- (ii) Find the shortest distance from the origin to the circle C_1 . Give your answer correct to two decimal places. [5]

- (b) The line L has equation $y = 3x - 1$. The line L and the circle C_1 intersect at the points P and Q .

- (i) Find the coordinates of P and Q .
- (ii) The circle C_2 has centre $B(6, 7)$ and is such that PQ is the common chord of C_1 and C_2 . Find the equation of C_2 . [7]

(C2 Summer 2017)

8. The circle C has centre A and equation

$$x^2 + y^2 + 10x - 8y + 21 = 0.$$

- (a) (i) Find the coordinates of A and the radius of C .
- (ii) The point P has coordinates $(-2, 0)$. Determine whether P lies inside C , on C or outside C . [5]
- (b) The line L has equation $y = 2x + 4$. Show that L is a tangent to the circle C and find the coordinates of the point of contact of L and C . [5]

(C2 Summer 2018)

8. The circle C_1 has centre $A(2, -1)$ and passes through the point $P(6, 1)$.

- (a) (i) Show that the equation of C_1 is given by

$$x^2 + y^2 - 4x + 2y - 15 = 0.$$

- (ii) Given that the point Q is such that PQ is a diameter of C_1 , find the coordinates of Q .
- (iii) Find the equation of the tangent to C_1 at P . [9]
- (b) The circle C_2 has centre $B(-4, 7)$ and radius $\sqrt{8}$. Find the shortest distance between C_1 and C_2 . Give your answer correct to one decimal place. [3]