

EQUITY

LEARNING PLACE

Additional Math Topical (**Further Coordinate Geometry**)

Question 1:

A circle C_1 whose equation is $x^2 + y^2 - 6x - 4y - 12 = 0$, has centre A and radius r .

- Find the coordinates of A and the value of r .
- Show that the point $B(6, -2)$ lies on the circle C_1 .
- Find the equation of the perpendicular bisector of AB .
- The perpendicular bisector of AB is the tangent to another circle C_2 , with centre B . Find the equation of circle C_2 .

Question 2:

A circle C_1 has equation given by $x^2 + y^2 - 2x + 6y - 15 = 0$ and the point $P(4, -7)$ is on C_1 .

- Find the radius and the coordinates of the centre of C_1 .
- The point Q is such that PQ is the diameter of the circle. Find the coordinates of Q .
- A new circle C_2 passes through P , Q and R , where R is a point outside the circle C_1 such that angle $PRQ = 45^\circ$. Explain briefly if it is possible for the centre of C_2 to lie on the circumference of C_1 .

Question 3:

The equation of a circle, C_1 with centre A , is $x^2 + y^2 + 6x - 4y - 7 = 0$.

- Find the coordinates of A and the radius of the circle.
- Circle C_1 intersects the x -axis at P and Q . Find the coordinates of P and of Q .
- A second circle, C_2 with centre B , also passes through P and Q . State the x -coordinate of B .
- Given that the y -coordinate of B is negative and that the radius of C_2 is $\sqrt{41}$, find the y -coordinate of B .
- Write down the equation of circle C_2 .

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Question 4:

The negative x -axis and the line $y = 10$ are tangents to a circle C .

a) What can be deduced about the coordinates of the centre of C and the relationship between the radius of C and the y -coordinate of the centre of C ?

The line l is a tangent to C at the point P . The point P has coordinates $(-7, 9)$. Given that the centre of C lies below and to the right of P , find

b) the equation of C

c) the equation of l

Question 5:

A circle, centre C , has a diameter PQ where P is the point $(-4, -3)$ and Q is the point $(8, 5)$.

a) Find the coordinates of C and the radius of the circle.

b) Find the equation of the circle.

c) Determine whether the point $R(-3.25, 5.5)$ lies inside, outside or on the circle. Show your working clearly.

Question 6:

A circle C passes through the points $(-1, 2)$, $(0, 5)$ and $(2, 1)$.

a) Show that the coordinates of the centre of circle C is $(1, 3)$.

b) Hence, find the equation of the circle C .

c) Find the equation of the circle which is a reflection of circle C in the line $x = 3$.

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Question 7:

A circle, whose equation $x^2 + y^2 - 4x - 10y - 7 = 0$, has centre C and radius r .

a) Find the coordinates of C and the value of r .

AB is a diameter of the circle and is parallel to the y -axis.

b) Find the coordinates of A and B .

Question 8:

The straight line $y = 5 - 2x$ meets the circle $x^2 + y^2 + 4x - 8y - 5 = 0$ with centre C at two points P and Q .

a) Find the coordinates of C and the radius of the circle.

b) Find the general form of the equation of another circle for which PQ is a diameter.

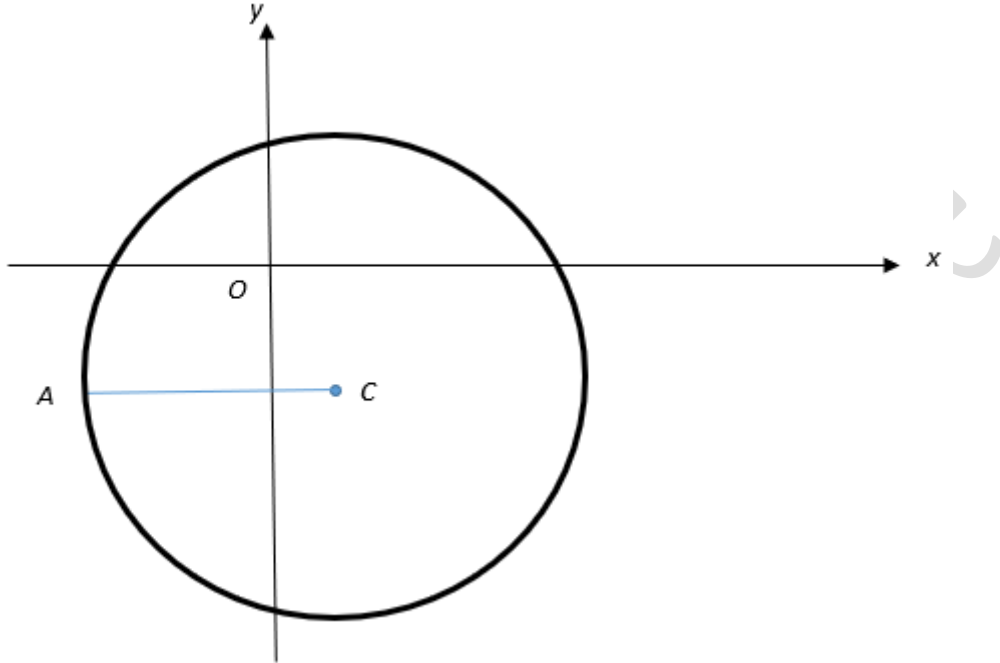
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Question 9:

The diagram below shows a circle with center $C(2, -1)$ and radius 5.



- (i) Given that the equation of the circle is $x^2 + y^2 + 2gx + 2fy + c = 0$, find the value of each of the constants g , f and c .
- (ii) The point A lies on the circle such that AC is parallel to the x -axis, write down the coordinates of A .
- (iii) The points B and D lie on the circle and forms the diameter. If the coordinates of B are $(6, 2)$, find the coordinates of D .

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Question 10:

C is a circle with equation $2x^2 + 2y^2 + 2x - y = 5$.

- Find the centre and radius of C .
- If a line of equation $y = mx + c$ is parallel to $y + 2x = 1$, what can one conclude about the value of m ?
- There are two lines parallel to $y + 2x = 1$ which are tangent to C . Find the equation of these two lines.

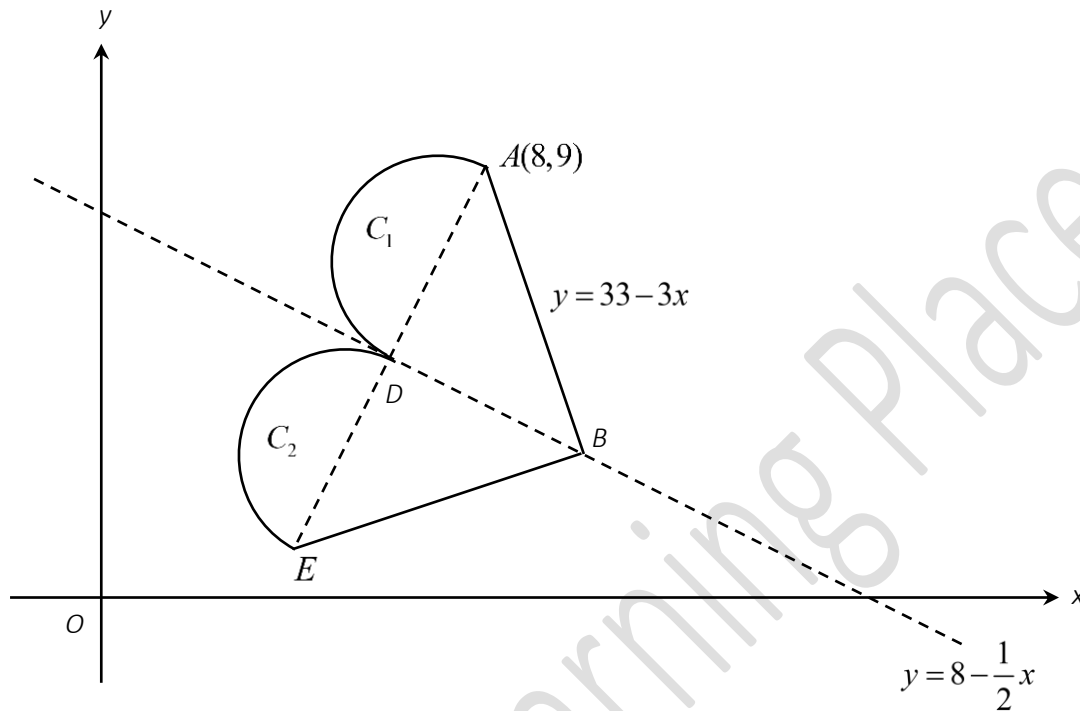
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Question 11:

Mandy drew a heart-shaped figure as shown in the diagram below.



She started by drawing the line $y = 33 - 3x$, which passes through points $A(8, 9)$ and B . She then drew the line of symmetry $y = 8 - \frac{1}{2}x$ through B and a dotted line through A which is perpendicular to the line of symmetry. The point of intersection between the two lines is D .

- i) Find the coordinates of B .
- ii) Show that the coordinates of D are $(6, 5)$.

She then plotted point E , which is the image of $A(8, 9)$ under reflection about the line of symmetry. Finally, Mandy drew two circles C_1 and C_2 with diameters AD and DE respectively, before erasing half of the circles to form two semicircles.

- iii) Find the equation of the circle C_1 which Mandy initially drew.
- iv) Find the equation of the line BE and use this equation to verify that the point $F(7, 2)$ lies on BE .
- v) To complete her drawing, Mandy drew an arrow through the points $A(8, 9)$ and $F(7, 2)$. Find the area of triangle ABF .

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Question 12:

A circle C_1 has equation $x^2 + y^2 - 4x + 6y - 3 = 0$.

- Find the coordinates of the centre and radius of circle C_1 .
- Find the coordinates on the circle C_1 where the gradient is equal to zero.

Another circle C_2 is a reflection about the line $y = 1$.

- Find the equation of circle C_2 .

Question 13:

The equation of a circle C_1 , with radius 5 units, is given by $x^2 + y^2 + 6x - 10y + k = 0$.

- Find the centre of C_1 and the value of k .

A second circle C_2 lies in the third quadrant of the Cartesian plane ($x < 0, y < 0$) and touches C_1 and the two axes.

- Find the equation of circle C_2 .

Question 14:

The equation of a circle is $x^2 + y^2 - 10x - 4y + 25 = 0$.

- Find the radius and the coordinates of the centre of the circle.
- Show that the x -axis is tangent to the circle.
- Find the equation of the circle which is a reflection of the original circle in the x -axis.

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Question 15:

The equation of a circle C_1 is $x^2 + y^2 + 2x - 6y - 90 = 0$.

- Find the centre and radius of the circle C_1 .
- The circle C_1 touches the line $y = a$ where $a > 0$. State the value of a .
- The circle C_1 is reflected in the line $x = 10$. State the centre of this new circle.
- A second circle C_2 has centre $(2, 7)$ and a radius of 5 units. Justify with workings that the two circles C_1 and C_2 touch each other at only one point.