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Coordinate Geometry (Circles)

(1) Find the midpoint of the following points:

- (a) (3, 7) and (1, 3)
(b) (-2, 3) and (4, -3)
(c) $\left(1, \frac{3}{4}\right)$ and $\left(\frac{7}{4}, -2\right)$

(2) Find the length of line segment AB for the following:

- (a) $A(1, 3)$ and $B(2, 5)$
(b) $A(-3, 2)$ and $B(2, -5)$
(c) $A(2, 0.5)$ and $B(-1, 3)$

(d) Given that the line segment AB is a diameter of a circle, state the radius of each circle in questions a – c.

(3) The points (2, 1) and (-2, -1) are the end points of a diameter of a circle.

- (a) Find the centre of the circle
(b) Find the length of the radius

(4) (a) The point $A\left(1, \frac{5}{4}\right)$ is a point on the circle C . Given that the centre of the circle has coordinates (1.75, -1), find the coordinates of the point B such that AB is a diameter of the circle C .

(b) Find the length of the diameter AB to 3 significant figures.

(5) Write down the centre of each circle and the length of its radius:

- (a) $x^2 + y^2 = 25$
(b) $(x-1)^2 + (y+2)^2 = 16$
(c) $(x+5)^2 + (y-0.5)^2 = 32$
(d) $(y+2)^2 + (x-14)^2 = 27$
(e) $(x-3)^2 + y^2 - 0.01 = 0$
(f) $(2x-3)^2 + (2y+5)^2 = 36$
(g) $(x-p)^2 + (y+q)^2 = r$
(h) $(px+4)^2 + (py+2)^2 = p^2$

(6) Find the centre of each circle and the length of its radius where possible:

- (a) $x^2 + y^2 + 2x - 4y = 20$
(b) $x^2 + y^2 - 3x + y = 13.5$
(c) $x^2 - \sqrt{3}x + y^2 = 24.25$
(d) $x^2 + 2x = 4y + y^2$
(e) $x^2 + y^2 + px - 4py = 17p$
(f) $2x^2 + 2y^2 + 4x - 3y = 26$
(g) $y^2 + (x-3)^2 = 8y$
(h) $qx^2 - 6x - 2y + qy^2 = 0$
(Can you spot the equation that isn't a circle?)

(7) The point $A(2, 3)$ lies on the circle C . The centre of the circle has coordinates (8, 1). Find an equation for the circle.

(8) The points $P(2, 3)$ and $Q(6, 9)$ lie on the circle C .

Given PQ is a diameter of the circle, find an equation of the circle C .

(9) The circle with equation $x^2 - 2x - 4y + y^2 = 48$ crosses the x axis at the points A and B .

- (a) Find the area of the triangle ABC where C is the centre of the circle.
(b) The circle crosses the y axis at the points D and E . Find the length of the chord DE in the form $p\sqrt{q}$ where q is a prime number.

(10) A circle has equation $(x-4)^2 + (y+3)^2 = 20$. State

whether the following points are inside, on the circle or outside the circle:

- (a) (5, 1), (b) (0, 7), (c) (9, -2)

(11) A circle with centre (6, -1) passes through the point $T(-3, 2)$. Find an equation for the tangent to the circle at the point T .

(12) A tangent to the circle C at the point P passes through the point $Q(10, -3)$. Given that the equation of circle C is $(x-2)^2 + (y+1)^2 = 16$, find the length of the line PQ .

(13) A circle has equation $(x-3)^2 + (y-5)^2 = 100$.

(a) Show that the points $P(11, -1)$ and $Q(-3, -3)$ lie on the circle.

The line l is the perpendicular bisector of the chord PQ .

(b) Show that line l passes through the centre of the circle.

(14) The points $A(-2, 12)$, $B(-5, 11)$ and $C(3, -3)$ lie on a circle. Find an equation of the circle.

(15) The points $A(0, 4)$, $B(-3, -5)$ and $C(6, -8)$ lie on a circle.

- (a) Prove that AC is a diameter of the circle.
(b) Find an equation of the circle.

(16) A circle has equation $(x+4)^2 + (y-7)^2 = 90$.

(a) Write down the coordinates of the centre and the length of the radius.

The points $A(-13, 10)$ and $B(-7, -2)$ lie on the circle.

(b) Find the area of the triangle ABC where C is the centre of the circle.

(17) A circle touches the y axis at the point (0, -8) and crosses the x axis at the points (-4, 0) and (-16, 0). Find an equation for the circle.

(18) A circle passes through the points $A(6, 3)$ and $B(-2, 11)$ and has centre $C(-2, p)$.

- (a) Find the value of p
- (b) Find an equation of the tangent to the circle at the point $(6, 3)$.
- (c) The point D has coordinates $(-10, 3)$. Show that AD is a diameter of the circle.
- (d) Show that $\angle ABD = 90^\circ$

(19) The line $y = x + c$ is a tangent to a circle with the equation $(x - 4)^2 + (y - 1)^2 = 98$.

- (a) Find the possible values of c .
- (b) Find the possible points where the tangent could touch the circle.

(20) The circle with equation $(x - 6)^2 + (y + 4)^2 = r^2$ does not cross either coordinate axis.

- (a) Find the set of value of r^2 that satisfy this condition.
- (b) Given further that $r^2 = 9$, find the coordinates of the point P such that P is the furthest point on the circle from the x axis.
- (c) Write down the equation of the tangent to the circle at the point P .