

Exercise walk-through

2.3

Coordinate geometry of the circle

Pearson Edexcel · International A-Level · Mathematics

Check yourself

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Exhaustion with complete cases; counterexamples; factor/remainder theorems with $(ax - b)$; circles from any form plus the three properties; both series families with proofs and logs; binomial coefficients; log laws with domain checks; identity-reduced trig equations in either unit; stationary points classified and modelled; areas by definite integral and by the trapezium rule with the error direction.

Exercises 2.1·2.3

2.1 Find the centre and radius of $x^2 + y^2 + 8x - 2y + 8 = 0$. [3]

2.2 Write the equation of the circle with centre $(2, -5)$ and radius $\sqrt{13}$. [2]

2.3 Determine whether $(5, 2)$ lies on the circle $(x - 1)^2 + (y - 3)^2 = 17$. [2]

Exercises 2.1·2.3

2.1 Find the centre and radius of $x^2 + y^2 + 8x - 2y + 8 = 0$. [3]

2.1 $(x + 4)^2 + (y - 1)^2 = 9$: centre $(-4, 1)$, radius 3.

2.2 Write the equation of the circle with centre $(2, -5)$ and radius $\sqrt{13}$. [2]

2.2 $(x - 2)^2 + (y + 5)^2 = 13$.

2.3 Determine whether $(5, 2)$ lies on the circle $(x - 1)^2 + (y - 3)^2 = 17$. [2]

2.3 $(5 - 1)^2 + (2 - 3)^2 = 16 + 1 = 17$ – yes, the point lies on the circle.

Exercises 2.4·2.5

2.4 The points $(-3, 1)$ and $(5, 7)$ are the ends of a diameter. Find the circle's equation. [4]

2.5 The circle $x^2 + y^2 = 10$ passes through $(3, 1)$. Find the equation of the tangent at that point. [4]

Exercises 2.4·2.5

2.4 The points $(-3, 1)$ and $(5, 7)$ are the ends of a diameter. Find the circle's equation.[4]

2.4 Centre: midpoint $= (1, 4)$. Diameter squared: $8^2 + 6^2 = 100$, so $r^2 = 25$.

$$(x - 1)^2 + (y - 4)^2 = 25$$

Check both endpoints: $16 + 9 = 25$ ✓ twice.

2.5 The circle $x^2 + y^2 = 10$ passes through $(3, 1)$. Find the equation of the tangent at that point. [4]

2.5 The radius to $(3, 1)$ has gradient $\frac{1}{3}$; the tangent's gradient is -3 :

$$y - 1 = -3(x - 3) \implies y = -3x + 10$$

Check: the tangent passes $(3, 1)$ ✓, and $-3 \times \frac{1}{3} = -1$ (perpendicular) ✓.

Exercise 3.1

3.1 (*Adapted from Edexcel IAL WMA12 June 2025 Q2.*) The line joining $(-1, -3)$ and $(7, 1)$ is the diameter of circle C .

(a) Find an equation for C .

(b) Hence find the exact coordinates of the point on C that is nearest the x -axis. [7]

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3.1 (*Adapted from Edexcel IAL WMA12 June 2025 Q2.*) The line joining $(-1, -3)$ and $(7, 1)$ is the diameter of circle C .

(a) Find an equation for C .

(b) Hence find the exact coordinates of the point on C that is nearest the x -axis. [7]

3.1 (a) Centre: $\left(\frac{-1+7}{2}, \frac{-3+1}{2}\right) = (3, -1)$. Diameter squared: $8^2 + 4^2 = 80$, so $r^2 = 20$:

$$(x - 3)^2 + (y + 1)^2 = 20$$

Check an endpoint: $(-4)^2 + 2^2 = 20$ ✓. (b) Nearest the x -axis means straight below the centre (the centre is 1 unit below the axis, less than $r = \sqrt{20} \approx 4.47$, so the circle crosses the axis; the lowest point is r below the centre):

$$(3, -1 - \sqrt{20}) = (3, -1 - 2\sqrt{5})$$

Exercise 3.2

3.2 The circle $(x - 4)^2 + (y - 2)^2 = 25$ meets the line $x = 0$ at $A(0, 5)$ and $B(0, -1)$.
Verify that the perpendicular from the centre to the chord AB bisects AB . [3]

Exercise 3.2

3.2 The circle $(x - 4)^2 + (y - 2)^2 = 25$ meets the line $x = 0$ at $A(0, 5)$ and $B(0, -1)$. Verify that the perpendicular from the centre to the chord AB bisects AB . [3]

3.2 The centre is $(4, 2)$. The perpendicular from $(4, 2)$ to the vertical chord $x = 0$ is the horizontal line $y = 2$, meeting AB at $(0, 2)$. The midpoint of $A(0, 5)$ and $B(0, -1)$ is $\left(0, \frac{5+(-1)}{2}\right) = (0, 2)$ – the same point, so the perpendicular bisects the chord ✓.

Local review guidance: midpoint/completing-the-square method; exact centre, radius and equation; property applied with the right perpendicular. This is authored classroom guidance.