inkMaths

ANSWER BOOK

Circles

Coordinate geometry · Year 12–13

7 questions · 20 marks

NAVY EDITION

inkmaths.co.uk

SECTION A · Warm-up

A1 $(x - 2)^2 + (y + 3)^2 = 16$. The signs flip on the way in, and the radius is squared: both of the usual slips in one line. [2]

A2 Centre $(-1, 5)$, radius $\sqrt{49} = 7$. Reading $(x + 1)$ as centre -1 is the flip in reverse; quoting the radius as 49 is the other frequent miss. [2]

SECTION B · Standard

B1 Complete the square in each variable: $(x - 2)^2 - 4 + (y + 3)^2 - 9 - 3 = 0$, so $(x - 2)^2 + (y + 3)^2 = 16$. Centre $(2, -3)$, radius 4. The three loose constants must all migrate to the right before the square root. [3]

B2 Substitute the point into the left side: $(5 - 2)^2 + (1 + 3)^2 = 9 + 16 = 25$. Since 25 > 16, the point's distance from the centre beats the radius: it lies outside. Comparing the squared distance with r^2 avoids any square roots. [2]

B3 Check the point first: $3^2 + 4^2 = 25$, so it is on the circle. The radius from $(1, 2)$ to $(4, 6)$ has gradient $4/3$, so the tangent's gradient is the negative reciprocal, $-3/4$. Through $(4, 6)$: $y - 6 = -(3/4)(x - 4)$, which clears to $3x + 4y - 36 = 0$. No calculus appears; the perpendicular-radius fact does all the work. [4]

B4 The perpendicular from the centre bisects the chord, making a right triangle with hypotenuse 5 and one leg 3. The half-chord is $\sqrt{(25 - 9)} = 4$, so the chord has length 8. The 3-4-5 triangle, hiding in a circle. [3]

SECTION C · Stretch

C1 $3^2 + 4^2 = 25$, so C is on the circle. The vector from C to A is $(-8, -4)$ and from C to B is $(2, -4)$; the gradients are $1/2$ and -2, whose product is -1, so CA is perpendicular to CB. This is the angle-in-a-semicircle theorem caught in the act: any point of the circle other than A and B would do the same. [3]