

| Question | Scheme | Marks |
|----------------|--|--|
| 7(a) | $x = -\frac{5}{4}$ | B1 [1] |
| (b) | $\left\{\frac{dy}{dx}\right\} = \frac{2x(4x+5) - 4(x^2-1)}{(4x+5)^2}$ $y = 0$ $\left\{\frac{dy}{dx}\right\} = \frac{2(-1)(4(-1)+5) - 4((-1)^2-1)}{(4(-1)+5)^2} = -2$ $\rightarrow \{\text{gradient of normal} = \frac{1}{2}\}$ $y - 0 = \frac{1}{2}(x - (-1)) \text{ oe}$ | M1A1A1 B1 M1 M1A1cso [7] |
| (c) | $\frac{x+1}{2} = \frac{x^2-1}{4x+5}$ $2x^2 + 9x + 7 = 0 \text{ OR } (x+1)(4x+5) = 2(x+1)(x-1)$ $(2x+7)(x+1) = 0 \Rightarrow x = \dots \text{ OR } (4x+5) = 2(x+1) \Rightarrow x = \dots$ $x = -\frac{7}{2}, \{x = -1\}$ $y = \frac{-\frac{7}{2} + 1}{2} = \dots$ $\left(-\frac{7}{2}, -\frac{5}{4}\right)$ | M1 dM1 ddM1 A1 M1 A1 [6] |
| Total 14 marks | | |

| Part | Mark | Notes |
|------|-------|--|
| (a) | B1 | $x = -\frac{5}{4}$ or $x = -1.25$, do not accept $4x+5=0$ |
| (b) | M1 | <p>Attempts to differentiate y.</p> <p>Quotient Rule: Look for $\frac{Px(4x+5) - Q(x^2-1)}{(4x+5)^2}, \text{ where } P > 0, Q > 0$</p> <p>If the quotient rule is quoted, it must be correct. Condone invisible bracket for this mark.</p> <p>Product Rule: Look for $Px(4x+5)^{-1} \pm Q(x^2-1)(4x+5)^{-2}$, where $P > 0, Q > 0$</p> |
| | A1 | Quotient rule: Correct denominator $(4x+5)^2$ and one correct term in the numerator, $2x(4x+5)$ or $-4(x^2-1)$. Product rule: One term correct |
| | A1 | Fully correct. $\left\{\frac{dy}{dx} = \right\} \frac{2x(4x+5) - 4(x^2-1)}{(4x+5)^2}$ or $\left\{\frac{dy}{dx} = \right\} 2x(4x+5)^{-1} - 4(x^2-1)(4x+5)^{-2}$ oe |
| | B1 | $y = 0$ seen or implied |
| | M1 | Correct method finding gradient of normal to the curve where $x = -1$ |
| | M1 | Correct method of forming the equation of a straight line using the point (-1, their y value) with a “ changed ” gradient. (“changed” means a different gradient from their tangent gradient, their normal could be found by an incorrect method) If using $y = mx + c$, a value for c must be found and the equation formed. |
| | A1cso | For the correct line in any form, simplified or unsimplified. (isw) Once correct equation is seen, award the mark, ignore later incorrect simplification. e.g. $2y = x + 1$ or $2y - x - 1 = 0$ or $y = 0.5x + 0.5$ oe or even $y - 0 = \frac{1}{2}(x - (-1))$ |
| (c) | M1 | For equating the equation of their line with the equation of the curve. |
| | dM1 | For forming an equation with all like terms collected. OR cross multiplies then factorises e.g. $2(x^2 - 1) = 2(x + 1)(x - 1)$ |
| | ddM1 | Solves their equation with a correct method and finds at least one real value of x which is not -1, method of solving could be implied by correct answers if calculator used. OR cancels $(x+1)$ and solves their linear equation. |
| | A1 | $x = -\frac{7}{2}, \quad \{x = -1\}$ |
| | M1 | For substituting their x value (not -1) to either the equation of their normal or the equation of the given curve to find a value for y |
| | A1 | For the correct exact coordinates of $D\left(-\frac{7}{2}, -\frac{5}{4}\right)$ oe Allow $x = -3.5, y = -1.25$ instead of given as coordinates. |
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