7 **(a)** Given that $y = x^3 \ln x$, find $\frac{\mathrm{d}y}{\mathrm{d}x}$. [2]

(b) Hence find $\int_1^2 3x^2 \ln x \, \mathrm{d}x$, giving your answer in the form $\ln a + b$, where a is an integer and b is a rational number. [4]

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8 The straight line $y = 2x + 1$ intersects the curve $y + xy + 3x^2 = 15$ at the points A and B. The point C with coordinates $\left(\frac{21}{10}, k\right)$ lies on the perpendicular bisector of AB.

(a) Find the exact value of k. [8]

(b) The point D lies on the perpendicular bisector of AB such that its perpendicular distance from AB is twice that of the point C from AB. Find the possible coordinates of D. [4]

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