8 A curve has equation $y = x \sin 2x$.

(a) Find $\frac{\mathrm{d}y}{\mathrm{d}x}$. [2]

(b) Find the equation of the tangent to the curve at $x = \frac{\pi}{4}$. [3]

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(c) Use your answer to **part (a)** to find the exact value of $\int_0^{\frac{\pi}{6}} 2x\cos 2x \mathrm{d}x$. [5]