8 The equation of a curve is $y = x\sin x$.

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

(b) Find the equation of the tangent to the curve at $x = \frac{\pi}{2}$ in the form $y = mx + c$. [3]

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(c) Use your answer to **part (a)** to find $\int x\cos x\,\mathrm{d}x$. [3]

(d) Evaluate $\int_0^{\frac{\pi}{4}} x\cos x\,\mathrm{d}x$, giving your answer correct to 2 significant figures. [2]

9 The functions $f(x)$ and $g(x)$ are defined as follows for $x > -\frac{1}{3}$ by

$$f(x) = x^2 + 1,$$
$$g(x) = \ln(3x + 2).$$

(a) Find $fg(x)$. [1]

(b) Solve the equation $fg(x) = 5$ giving your answer in exact form. [3]

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