(a) Use integration by parts to find $\int x\sin 3x\ dx$.   **3**

(b) Hence find the particular solution of

$$\frac{dy}{dx} - \frac{2}{x}y = x^3\sin 3x, \quad x \neq 0$$

given that $x = \pi$ when $y = 0$.

Express your answer in the form $y = f(x)$.   **7**

Answers:

(a) $-\frac{x}{3}\cos 3x + \frac{1}{9}\sin 3x + c$

(b) $y = -\frac{x^3}{3}\cos 3x + \frac{x^2}{9}\sin 3x - \frac{\pi x^2}{3}$