2 **(a)** Find $\frac{\mathrm{d}}{\mathrm{d}x}\left(x^2 \mathrm{e}^{3x}\right)$. [3]

(b) **(i)** Find $\frac{\mathrm{d}}{\mathrm{d}x}\left(3x^2+4\right)^{\frac{1}{3}}$. [2]

(ii) Hence find $\int_0^2 x\left(3x^2+4\right)^{-\frac{2}{3}}\,\mathrm{d}x$. [3]

3 Solve the equation $\operatorname{cosec}^2\theta + 2\cot^2\theta = 2\cot\theta + 9$, where θ is in radians and $-\frac{\pi}{2} < \theta < \frac{\pi}{2}$. [5]