1 Find the possible values of the constant k such that the equation $kx^2 + 4kx + 3k + 1 = 0$ has two different real roots. [4]

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]