4 **(a)** Find $\int_0^{\pi} \sin\theta \, \mathrm{d}\theta$. [2]

(b) Given that $0 < \alpha < \frac{\pi}{2}$, show that $\frac{\sec\alpha}{\cot\alpha + \tan\alpha}$ can be written as $\sin\alpha$. [3]

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

5 The polynomial p is such that $\mathrm{p}(x) = 3x^3 - 7x^2 + ax + b$, where a and b are integers.

It is given that $\mathrm{p}'(-1) = 21$ and that $x - 2$ is a factor of $\mathrm{p}(x)$.

(a) Find the values of a and b. [4]

(b) Hence write $\mathrm{p}(x)$ as a product of linear factors with integer coefficients. [3]

(c) Using your values of a and b, solve the equation $3\mathrm{e}^{6y} - 7\mathrm{e}^{4y} + a\mathrm{e}^{2y} + b = 0$. [3]