9 **(a)** By sketching a suitable pair of graphs, show that the equation

$$\sec 2x = -e^{x}$$

has only one root in the interval $0 < x < \frac{1}{2}\pi$. [2]

(b) Show by calculation that this root lies between 0.9 and 1. [2]

(c) Show that if a sequence of values given by the iterative formula

$$x_{n+1} = \frac{1}{2}\cos^{-1}\left(-e^{-x_n}\right)$$

converges, then it converges to the root of the equation in part **(a)**. [1]

(d) Use the iterative formula given in part **(c)** to calculate x correct to 3 decimal places. Give the result of each iteration to 5 decimal places. [3]