

5. (i) Evaluate the improper integral

$$\int_1^{\infty} 2e^{-\frac{1}{2}x} dx \quad (3)$$

- (ii) The air temperature,  $\theta^\circ\text{C}$ , on a particular day in London is modelled by the equation

$$\theta = 8 - 5 \sin\left(\frac{\pi}{12}t\right) - \cos\left(\frac{\pi}{6}t\right) \quad 0 \leq t \leq 24$$

where  $t$  is the number of hours after midnight.

- (a) Use calculus to show that the mean air temperature on this day is  $8^\circ\text{C}$ , according to the model. (3)

Given that the actual mean air temperature recorded on this day was higher than  $8^\circ\text{C}$ ,

- (b) explain how the model could be refined. (1)