Marks

Question 8 (12 marks) Use a SEPARATE writing booklet.

(a) A drug is used to control a medical condition. It is known that the quantity Q of drug remaining in the body after t hours satisfies an equation of the form

$$Q = Q_o\, e^{-kt}$$

where Q_o and k are constants.

The initial dose is 6 milligrams and after 15 hours the amount remaining in the body is half the initial dose.

(i) Find the values of Q_o and k. **3**

(ii) When will one-eighth of the initial dose remain? **2**

(b) A particle moves in a straight line. At time t seconds, its distance x metres from a fixed point O on the line is given by

$$x = \sin 2t + 3.$$

(i) Sketch the graph of x as a function of t for $0 \leq t \leq 2\pi$. **3**

(ii) Using your graph, or otherwise, find the times when the particle is at rest, and the position of the particle at those times. **2**

(iii) Describe the motion completely. **2**