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3. A particle P of mass 0.25 kg is moving on a smooth horizontal surface under the action of a single force, **F** newtons.

At time t seconds $(t \geqslant 0)$, the velocity $\mathbf{v}\,\text{m s}^{-1}$ of P is given by

$$\mathbf{v} = (6\sin 3t)\mathbf{i} + (1 + 2\cos t)\mathbf{j}$$

(a) Find **F** in terms of t.

(3)

At time $t = 0$, the position vector of P relative to a fixed point O is $(4\mathbf{i} - \sqrt{3}\mathbf{j})\,\text{m}$.

(b) Find the position vector of P relative to O when P is first moving parallel to the vector **i**.

(6)

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