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5. At time t seconds ($t \geqslant 0$), a particle P has velocity $\mathbf{v}\,\text{m}\,\text{s}^{-1}$, where

$$\mathbf{v} = (3t^2 - 4)\mathbf{i} + (2t - 4)\mathbf{j}$$

When $t = 0$, P is at the fixed point O.

(a) Find the acceleration of P at the instant when $t = 0$

(2)

(b) Find the exact speed of P at the instant when P is moving in the direction of the vector $(11\mathbf{i} + \mathbf{j})$ for the second time.

(4)

(c) Show that P never returns to O.

(4)

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Question 5 continued

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(Total 10 marks)