2. **In this question, solutions relying on calculator technology are not acceptable.**

[In this question, position vectors are given relative to a fixed origin O.]

A particle P is moving in the xy-plane.

At time t seconds, where $t \geqslant 0$, particle P is moving with acceleration $\mathbf{a}\,\mathrm{m\,s^{-2}}$ where

$$\mathbf{a} = (1 - 3t)\mathbf{i} + (2t^2 - 2t)\mathbf{j}$$

At time $t = 0$

- P passes through the point with position vector $(\mathbf{i} + \mathbf{j})\,\mathrm{m}$
- P is moving with velocity $(3\mathbf{i} - 2\mathbf{j})\,\mathrm{m\,s^{-1}}$

(a) Find the velocity of P at time t seconds, where $t \geqslant 0$

(3)

(b) Find the position vector of P relative to O, when the acceleration of P is parallel to $(-\mathbf{i} - \mathbf{j})$.

(6)