**6** A particle $P$ of mass 2 kg moving on a horizontal straight line has displacement $x$ m from a fixed point $O$ on the line and velocity $v\,\text{m s}^{-1}$ at time $t$ s. The only horizontal force acting on $P$ has magnitude $\frac{1}{10}(2v-1)^2\text{e}^{-t}$ N and acts towards $O$. When $t = 0$, $x = 1$ and $v = 3$.

**(a)** Find an expression for $v$ in terms of $t$. [5]

**(b)** Find an expression for $x$ in terms of $t$. [4]