A particle P of mass 4 kg is moving in a horizontal straight line. At time t s the velocity of P is $v\,\mathrm{m\,s^{-1}}$ and the displacement of P from a fixed point O on the line is x m. The only force acting on P is a resistive force of magnitude $(4\mathrm{e}^{-x}+12)\mathrm{e}^{-x}$ N. When $t = 0$, $x = 0$ and $v = 4$.

(a) Show by integration that $v = \dfrac{1+3\,\mathrm{e}^{x}}{\mathrm{e}^{x}}$. [4]

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