

10

(b) (ii) particle moving downwards

1996

$$mv \frac{dv}{dx} = mg - mkv^2$$

$$\int \left(\frac{v dv}{\frac{g}{k} - v^2} \right) = k \int dx$$

$$-\frac{1}{2} \ln \left(\frac{g}{k} - v^2 \right) = kx + C$$

5

$$v = 0 \text{ when } x = 0 \Rightarrow -\frac{1}{2} \ln \left(\frac{g}{k} \right) = 0 + C$$

$$\Rightarrow \frac{1}{2} \ln \left(\frac{g}{k} \right) - \frac{1}{2} \ln \left(\frac{g}{k} - v^2 \right) = kx$$

5

Find v when $x = \frac{\ln 3}{2k}$

$$\frac{1}{2} \ln \left(\frac{g}{k} \right) - \frac{1}{2} \ln \left(\frac{g}{k} - v^2 \right) = \frac{\ln 3}{2}$$

$$\ln \left(\frac{\frac{g}{k}}{\frac{g}{k} - v^2} \right) = \ln 3$$

$$v = \sqrt{\frac{2g}{3k}}$$

5

15