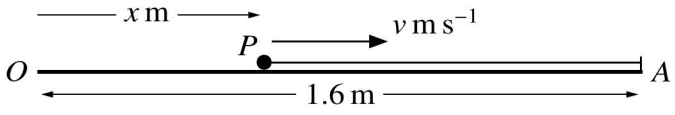

A particle P of mass 0.5 kg is projected along a smooth horizontal surface towards a fixed point A. Initially P is at a point O on the surface, and after projection, P has a displacement from O of x m and velocity v m s^{-1}. The particle P is connected to A by a light elastic string of natural length 0.8 m and modulus of elasticity 16 N. The distance OA is 1.6 m (see diagram). The motion of P is resisted by a force of magnitude $24x^2$ N.

(i) Show that $v\dfrac{\mathrm{d}v}{\mathrm{d}x} = 32 - 40x - 48x^2$ while P is in motion and the string is stretched. [3]

The maximum value of v is 4.5.

(ii) Find the initial value of v. [5]