

O and A are fixed points on a rough horizontal surface, with $OA = 1$ m. A particle P of mass 0.4 kg is projected horizontally with speed $U \text{ m s}^{-1}$ from A in the direction OA and moves in a straight line. After projection, when the displacement of P from O is x m, the velocity of P is $v \text{ m s}^{-1}$. The coefficient of friction between the surface and P is 0.4 . A force of magnitude $\frac{0.8}{x}$ N acts on P in the direction PO .

(i) Show that, while the particle is in motion, $v \frac{dv}{dx} = -4 - \frac{2}{x}$. [3]

It is given that P comes to instantaneous rest between $x = 2.0$ and $x = 2.1$.

(ii) Find the set of possible values of U . [5]