A particle P of mass $0.5\,\text{kg}$ is at rest at a point O on a rough horizontal surface. At time $t = 0$, where t is in seconds, a horizontal force acting in a fixed direction is applied to P. At time $t\,\text{s}$ the magnitude of the force is $0.6t^2\,\text{N}$ and the velocity of P away from O is $v\,\text{m s}^{-1}$. It is given that P remains at rest at O until $t = 0.5$.

(i) Calculate the coefficient of friction between P and the surface, and show that

$$\frac{\mathrm{d}v}{\mathrm{d}t} = 1.2t^2 - 0.3 \quad \text{for } t > 0.5.$$

[3]

(ii) Express v in terms of t for $t > 0.5$. [3]

(iii) Find the displacement of P from O when $t = 1.2$. [3]