

13 In this question \mathbf{i} and \mathbf{j} are unit vectors in the x - and y -directions respectively.

The velocity of a particle at time t s is given by $(3t^2\mathbf{i} + 7\mathbf{j}) \text{ m s}^{-1}$. At time $t = 0$ the position of the particle with respect to the origin is $(-\mathbf{i} + 2\mathbf{j}) \text{ m}$.

(a) Determine the distance of the particle from the origin when $t = 2$. **[6]**

(b) Show that the cartesian equation of the path of the particle is $x = \left(\frac{y-2}{7}\right)^3 - 1$. **[3]**

(c) At time $t = 2$, the magnitude of the resultant force acting on the particle is 48 N.

Find the mass of the particle.

[4]