

Solutionbank M1

Heinemann Modular Maths for Edexcel AS and A-level

8 Momentum

Exercise B, Question 3

Question:

Particle A has mass 5 kg and velocity $\begin{bmatrix} 3 \\ 7 \end{bmatrix}$ m s⁻¹ when it collides with particle B , which has mass 4 kg. After the collision the particles move together with velocity $\begin{bmatrix} 1 \\ 4 \end{bmatrix}$ m s⁻¹. Find the velocity of B before the collision.

Solution:

Using conservation of momentum,

with $\begin{bmatrix} u_1 \\ u_2 \end{bmatrix}$ being the velocity of B before the collision,

$$5 \begin{bmatrix} 3 \\ 7 \end{bmatrix} + 4 \begin{bmatrix} u_1 \\ u_2 \end{bmatrix} = 9 \begin{bmatrix} 1 \\ 4 \end{bmatrix}$$

$$\begin{bmatrix} 15 + 4u_1 \\ 35 + 4u_2 \end{bmatrix} = \begin{bmatrix} 9 \\ 36 \end{bmatrix}$$

$$\text{Using i components; } 15 + 4u_1 = 9 \quad \Rightarrow \quad u_1 = -1.5$$

$$\text{Using j components; } 35 + 4u_2 = 36 \quad \Rightarrow \quad u_2 = 0.25$$

$$\therefore \text{ Velocity of } B \text{ was } \begin{bmatrix} -1.5 \\ 0.25 \end{bmatrix} \text{ m s}^{-1}.$$