

Solutionbank M1

Heinemann Modular Maths for Edexcel AS and A-level

Exam style practice papers

Exercise MM1A, Question 2

Question:

Two particles, A and B , are moving on a horizontal surface when they collide. Before the collision the velocity of A is $\begin{bmatrix} 3 \\ 6 \end{bmatrix} \text{ m s}^{-1}$ and the velocity of B is $\begin{bmatrix} -5 \\ 4 \end{bmatrix} \text{ m s}^{-1}$. After the collision, both particles move together with velocity \mathbf{v} .

(a) If the mass of A is 2 kg and the mass of B is 3 kg, find \mathbf{v} . (3 marks)

(b) If the particles have the same mass, find \mathbf{v} . (3 marks)

Solution:

(a) Using conservation of momentum

$$2 \begin{bmatrix} 3 \\ 6 \end{bmatrix} + 3 \begin{bmatrix} -5 \\ 4 \end{bmatrix} = 5\mathbf{v}$$

$$\begin{bmatrix} 6 \\ 12 \end{bmatrix} + \begin{bmatrix} -15 \\ 12 \end{bmatrix} = 5\mathbf{v}$$

$$\begin{bmatrix} -9 \\ 24 \end{bmatrix} = 5\mathbf{v}$$

$$\therefore \mathbf{v} = \begin{bmatrix} -1.8 \\ 4.8 \end{bmatrix} \text{ m s}^{-1}$$

(b) Let both particles have mass m kg; using conservation of momentum

$$m \begin{bmatrix} 3 \\ 6 \end{bmatrix} + m \begin{bmatrix} -5 \\ 4 \end{bmatrix} = 2m \mathbf{v}$$

$$\begin{bmatrix} -2 \\ 10 \end{bmatrix} = 2\mathbf{v}$$

$$\mathbf{v} = \begin{bmatrix} -1 \\ 5 \end{bmatrix} \text{ m s}^{-1}$$

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