

# Solutionbank M1

Heinemann Modular Maths for Edexcel AS and A-level

## Exam style practice papers

### Exercise MM1B, Question 2

#### Question:

Two particles,  $A$  and  $B$ , have masses of 3 kg and 7 kg, respectively. They are moving on a horizontal surface when they collide. Just before the collision the velocity of  $A$  is  $\begin{bmatrix} 2 \\ -6 \end{bmatrix} \text{ m s}^{-1}$  and the velocity of  $B$  is  $\begin{bmatrix} -3 \\ 4 \end{bmatrix} \text{ m s}^{-1}$ .

(a) Find the velocity of the particles after the collision if they coalesce. (3 marks)

(b) Find the velocity of  $A$  after the collision, if the velocity of  $B$  is  $\begin{bmatrix} 0 \\ 1 \end{bmatrix} \text{ m s}^{-1}$ . (3 marks)

#### Solution:

(a) Using conservation of momentum

$$3 \begin{bmatrix} 2 \\ -6 \end{bmatrix} + 7 \begin{bmatrix} -3 \\ 4 \end{bmatrix} = 10\mathbf{v}$$

$$\begin{bmatrix} 6 \\ -18 \end{bmatrix} + \begin{bmatrix} -21 \\ 28 \end{bmatrix} = 10\mathbf{v}$$

$$\begin{bmatrix} -15 \\ 10 \end{bmatrix} = 10\mathbf{v}$$

$$\mathbf{v} = \begin{bmatrix} -1.5 \\ 1 \end{bmatrix}$$

$$\text{Velocity is } \begin{bmatrix} -1.5 \\ 1 \end{bmatrix} \text{ m s}^{-1}$$

(b) Using conservation of momentum

$$3 \begin{bmatrix} 2 \\ -6 \end{bmatrix} + 7 \begin{bmatrix} -3 \\ 4 \end{bmatrix} = 3\mathbf{v} + 7 \begin{bmatrix} 0 \\ 1 \end{bmatrix}$$

$$\begin{bmatrix} -15 \\ 10 \end{bmatrix} = 3\mathbf{v} + \begin{bmatrix} 0 \\ 7 \end{bmatrix}$$

$$3\mathbf{v} = \begin{bmatrix} -15 \\ 3 \end{bmatrix}$$

$$\mathbf{v} = \begin{bmatrix} -5 \\ 1 \end{bmatrix}$$

$$\therefore \text{Velocity is } \begin{bmatrix} -5 \\ 1 \end{bmatrix} \text{ m s}^{-1}.$$