

# Solutionbank M1

Heinemann Modular Maths for Edexcel AS and A-level

## 8 Momentum

### Exercise B, Question 1

#### Question:

Two particles,  $A$  and  $B$ , collide. After the collision they move together as a single particle. The mass of  $A$  is 12 kg and the mass of  $B$  is 8 kg. Before the collision, the velocity of  $A$  is  $(4\mathbf{i} - 6\mathbf{j}) \text{ m s}^{-1}$  and the velocity of  $B$  is  $(3\mathbf{i} + 2\mathbf{j}) \text{ m s}^{-1}$ . Find the velocity and the speed of the combined particle after the collision.

#### Solution:

Using conservation of momentum,

$$\begin{aligned} 12(4\mathbf{i} - 6\mathbf{j}) + 8(3\mathbf{i} + 2\mathbf{j}) &= 20\mathbf{v} \\ 48\mathbf{i} - 72\mathbf{j} + 24\mathbf{i} + 16\mathbf{j} &= 20\mathbf{v} \\ 72\mathbf{i} - 56\mathbf{j} &= 20\mathbf{v} \\ \mathbf{v} &= 3.6\mathbf{i} - 2.8\mathbf{j} \text{ m s}^{-1} \end{aligned}$$

Where  $\mathbf{v}$  is the velocity of the combined particle.

Speed of the combined particle is

$$\begin{aligned} &\sqrt{3.6^2 + (-2.8)^2} \\ &= 4.56 \text{ m s}^{-1}. \end{aligned}$$