

# Solutionbank M1

Heinemann Modular Maths for Edexcel AS and A-level

## 8 Momentum

### Exercise B, Question 6

#### Question:

Two particles,  $A$  and  $B$ , collide. The table gives the masses and velocities of the particles, where  $\alpha$  and  $\beta$  are constants.

Particle	Mass	Velocity before collision	Velocity after collision
$A$	4 kg	$(3\mathbf{i} + 5\mathbf{j}) \text{ m s}^{-1}$	$(\mathbf{i} + \alpha\mathbf{j}) \text{ m s}^{-1}$
$B$	6 kg	$(-2\mathbf{i} + 6\mathbf{j}) \text{ m s}^{-1}$	$(\beta\mathbf{i} + 2\mathbf{j}) \text{ m s}^{-1}$

Find  $\alpha$  and  $\beta$ .

#### Solution:

Using conservation of momentum;

$$4(3\mathbf{i} + 5\mathbf{j}) + 6(-2\mathbf{i} + 6\mathbf{j}) = 4(\mathbf{i} + \alpha\mathbf{j}) + 6(\beta\mathbf{i} + 2\mathbf{j})$$

$$12\mathbf{i} + 20\mathbf{j} - 12\mathbf{i} + 36\mathbf{j} = 4\mathbf{i} + 4\alpha\mathbf{j} + 6\beta\mathbf{i} + 12\mathbf{j}$$

$$56\mathbf{j} = (4 + 6\beta)\mathbf{i} + (4\alpha + 12)\mathbf{j}$$

$$\text{Using i components; } 0 = 4 + 6\beta$$

$$\beta = -\frac{2}{3}$$

$$\text{Using j components; } 56 = 4\alpha + 12$$

$$44 = 4\alpha$$

$$\therefore \alpha = 11$$