

Solutionbank M1

Heinemann Modular Maths for Edexcel AS and A-level

8 Momentum

Exercise Test yourself, Question 5

Question:

The mass of particle A is 3 kg and it moves with velocity $\begin{bmatrix} 2 \\ 3 \end{bmatrix} \text{ m s}^{-1}$. The mass of particle B is m kg

and it moves with velocity $\begin{bmatrix} k \\ 11 \end{bmatrix} \text{ m s}^{-1}$. The two particles collide and coalesce. After the collision

they move with velocity $\begin{bmatrix} 2 \\ 8 \end{bmatrix} \text{ m s}^{-1}$.

(a) Find m .

(b) Find k .

Solution:

(a) Using conservation of momentum

$$3 \begin{bmatrix} 2 \\ 3 \end{bmatrix} + m \begin{bmatrix} k \\ 11 \end{bmatrix} = (3 + m) \begin{bmatrix} 2 \\ 8 \end{bmatrix}$$

$$\begin{bmatrix} 6 + mk \\ 9 + 11m \end{bmatrix} = \begin{bmatrix} 6 + 2m \\ 24 + 8m \end{bmatrix} \quad [1]$$

Considering \mathbf{j} components

$$9 + 11m = 24 + 8m$$

$$3m = 15$$

$$m = 5$$

(b) Considering \mathbf{i} components of [1]

$$6 + mk = 6 + 2m$$

$$m = 5 \Rightarrow 6 + 5k = 16$$

$$k = 2$$