

## 12.4) Application to mechanics

## Worked example

Convert these vectors to scalar form:

- A force of  $\begin{pmatrix} 1 \\ -3 \\ 4 \end{pmatrix} N$
- An acceleration of  $\begin{pmatrix} 0 \\ 0 \\ 2 \end{pmatrix} ms^{-2}$
- A displacement of  $\begin{pmatrix} -6 \\ 8 \\ -24 \end{pmatrix} m$
- A velocity of  $\begin{pmatrix} 8 \\ -6 \\ 0 \end{pmatrix} ms^{-1}$

## Your turn

Convert these vectors to scalar form:

- A force of  $\begin{pmatrix} 3 \\ 4 \\ -1 \end{pmatrix} N$   
A force of 5.10 N (3 sf)
- An acceleration of  $\begin{pmatrix} 1 \\ 0 \\ 1 \end{pmatrix} ms^{-2}$   
An acceleration of 1.41  $ms^{-2}$  (3 sf)
- A displacement of  $\begin{pmatrix} 12 \\ -3 \\ 4 \end{pmatrix} m$   
A distance of 13 m
- A velocity of  $\begin{pmatrix} 0 \\ 4 \\ -3 \end{pmatrix} ms^{-1}$   
A speed of 5  $ms^{-1}$

## Worked example

A particle of mass 0.25 kg is acted on by three forces.

$$F_1 = (\mathbf{i} - 2\mathbf{j} + 3\mathbf{k}) \text{ N}$$

$$F_2 = (2\mathbf{i} - 4\mathbf{k}) \text{ N}$$

$$F_3 = (-5\mathbf{i} + 3\mathbf{j} + 4\mathbf{k}) \text{ N}$$

- Find the resultant force  $R$  acting on the particle.
- Find the acceleration of the particle, giving your answer in the form  $(p\mathbf{i} + q\mathbf{j} + r\mathbf{k}) \text{ ms}^{-2}$ .
- Find the magnitude of the acceleration.

Given that the particle starts at rest,

- Find the distance travelled by the particle in the first 3 seconds of its motion.

## Your turn

A particle of mass 0.5 kg is acted on by three forces.

$$F_1 = (2\mathbf{i} - \mathbf{j} + 2\mathbf{k}) \text{ N}$$

$$F_2 = (-\mathbf{i} + 3\mathbf{j} - 3\mathbf{k}) \text{ N}$$

$$F_3 = (4\mathbf{i} - 3\mathbf{j} - 2\mathbf{k}) \text{ N}$$

- Find the resultant force  $R$  acting on the particle.
- Find the acceleration of the particle, giving your answer in the form  $(p\mathbf{i} + q\mathbf{j} + r\mathbf{k}) \text{ ms}^{-2}$ .
- Find the magnitude of the acceleration.

Given that the particle starts at rest,

- Find the distance travelled by the particle in the first 6 seconds of its motion.

$$\text{a) } \begin{pmatrix} 5 \\ -1 \\ -3 \end{pmatrix} \text{ N}$$

$$\text{b) } \mathbf{a} = (10\mathbf{i} - 2\mathbf{j} - 6\mathbf{k}) \text{ ms}^{-2}$$

$$\text{c) } |\mathbf{a}| = \sqrt{140} \text{ ms}^{-2} = 11.83 \text{ ms}^{-2} \text{ (2 dp)}$$

$$\text{d) } 36\sqrt{35} \text{ m} = 212.98 \text{ m (2 dp)}$$