

Solutionbank M1

Heinemann Modular Maths for Edexcel AS and A-level

4 Forces

Exercise C, Question 4

Question:

Three forces $(3\mathbf{i} + 5\mathbf{j})\text{ N}$, $(4\mathbf{i} + 11\mathbf{j})\text{ N}$, $(2\mathbf{i} + \mathbf{j})\text{ N}$ act at a point. Given that \mathbf{i} and \mathbf{j} are perpendicular unit vectors find:

- the resultant of the forces in the form $a\mathbf{i} + b\mathbf{j}$,
- the magnitude of this resultant,
- the angle that the resultant makes with the unit vector \mathbf{i} . [A]

Solution:

$$\begin{aligned} \mathbf{R} &= (3\mathbf{i} + 5\mathbf{j}) + (4\mathbf{i} + 11\mathbf{j}) + (2\mathbf{i} + \mathbf{j}) \\ \therefore \mathbf{R} &= 9\mathbf{i} + 17\mathbf{j} \text{ N} \end{aligned}$$

$$\begin{aligned} |\mathbf{R}| &= \sqrt{9^2 + 17^2} \\ |\mathbf{R}| &= \sqrt{370} \\ |\mathbf{R}| &= 19.235\dots \\ \text{i.e. } |\mathbf{R}| &= 19.2 \text{ N (3 s.f.)} \end{aligned}$$

$$\begin{aligned} \tan \alpha &= \frac{17}{9} \\ \text{i.e. } \alpha &= 62.102\dots^\circ \end{aligned}$$

i.e. at 62.1° with the \mathbf{i} direction (3 s.f.)

