

Solutionbank M1

Heinemann Modular Maths for Edexcel AS and A-level

4 Forces

Exercise B, Question 7

Question:

The resultant of two forces of magnitude F_1 and F_2 has magnitude 12 N, and acts at an angle of 30° to F_1 . If $F_1 = 6$ N find the magnitude of F_2 and direction of F_2 .

Solution:

cosine rule

$$F_2^2 = 12^2 + 6^2 - 2 \times 12 \times 6 \times \cos 30^\circ$$

$$F_2^2 = 55.292\dots$$

$$\therefore F_2 = 7.4358\dots \text{ N}$$

$$\text{i.e. } F_2 = 7.44 \text{ N (3 s.f.)}$$

cosine rule

$$12^2 = 6^2 + 7.4358\dots^2 - 2 \times 6 \times 7.4358\dots \times \cos \beta$$

$$2 \times 6 \times 7.4358\dots \times \cos \beta = 6^2 + 7.4358^2 - 12^2$$

$$\therefore \cos \beta = \frac{(6^2 + 7.4358^2 - 12^2)}{(2 \times 6 \times 7.4358\dots)}$$

$$\therefore \beta = 126.20\dots^\circ$$

$$\begin{aligned} \therefore \alpha &= 180^\circ - \beta \\ &= 180^\circ - 126.20\dots^\circ \\ &= 53.793\dots^\circ \end{aligned}$$

$$\therefore \alpha = 53.8^\circ \text{ (3 s.f.)}$$

i.e. F_2 is at 53.8° with the direction of F_1 (3 s.f.)

