

Solutionbank M1

Heinemann Modular Maths for Edexcel AS and A-level

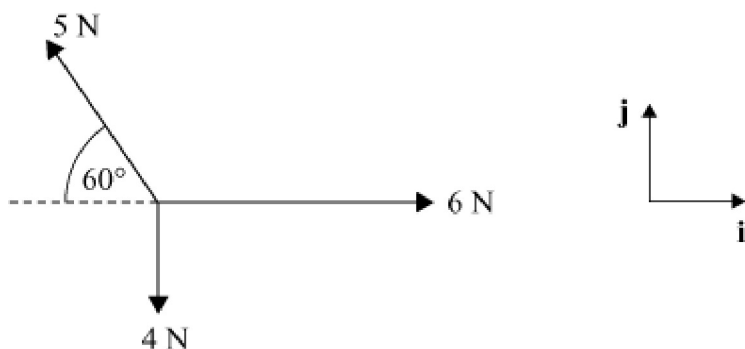
4 Forces

Exercise Test yourself, Question 2

Question:

The diagram shows three forces and the perpendicular unit vectors \mathbf{i} and \mathbf{j} .

- (a) Find the resultant of these three forces in terms of the unit vectors \mathbf{i} and \mathbf{j} .
- (b) Find the magnitude of the resultant of these three forces and draw a diagram to show the direction in which it acts.
- (c) When a fourth force acts at the same point the forces are in equilibrium. Find the magnitude of this force and describe the direction in which it acts.



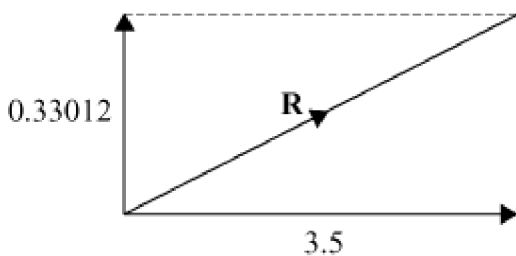
Solution:

$$\mathbf{R} = 6\mathbf{i} - 4\mathbf{j} + (-5 \cos 60^\circ \mathbf{i} + 5 \sin 60^\circ \mathbf{j})$$

$$\mathbf{R} = (6 - 5 \cos 60^\circ) \mathbf{i} + (5 \sin 60^\circ - 4) \mathbf{j}$$

$$(a) \quad \mathbf{R} = 3.5\mathbf{i} + 0.33012\mathbf{j}$$

$$\mathbf{R} = 3.5\mathbf{i} + 0.330\mathbf{j} \quad (3 \text{ s.f.})$$



$$|\mathbf{R}| = \sqrt{3.5^2 + 0.33012^2}$$

$$(b) \quad |\mathbf{R}| = 3.5155\dots$$

$$|\mathbf{R}| = 3.52 \text{ N} \quad (3 \text{ s.f.})$$

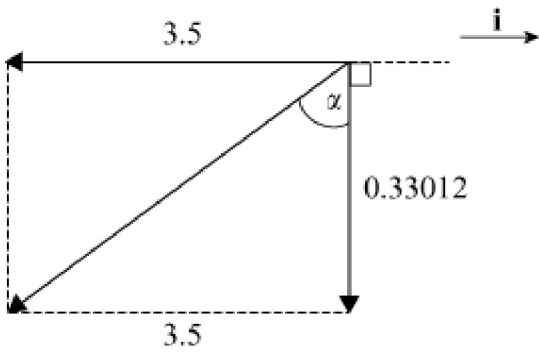
- (c) Fourth force has magnitude 3.52 N (3 s.f.)

$$\text{then } \tan \alpha = \frac{3.5}{0.33012\dots}$$

$$\alpha = 84.611\dots^\circ$$

$$\text{i.e. at angle } 90^\circ + \alpha = 90^\circ + 84.611^\circ$$

$$= 175^\circ \text{ (3 s.f.) below the } i \text{ direction.}$$



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