

Solutionbank M1

Heinemann Modular Maths for Edexcel AS and A-level

4 Forces

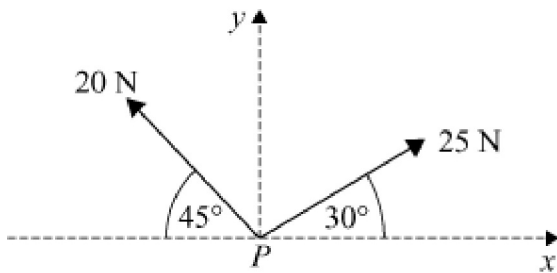
Exercise E, Question 20

Question:

A particle P , lies on a smooth horizontal surface. It is acted on by two horizontal forces of magnitudes 25 N and 20 N. Relative to horizontal axes Px and P_y , the directions of these two forces are as shown in the diagram. A third horizontal force \mathbf{F} is required to keep P in equilibrium.

(a) Express the force of magnitude 25 N as a column vector, giving its components to one decimal place.

(b) Obtain \mathbf{F} as a column vector, giving its components to one decimal place. [A]



Solution:

$$(a) \text{ the 25 N force is } \begin{bmatrix} 25 \cos 30^\circ \\ 25 \sin 30^\circ \end{bmatrix} = \begin{bmatrix} 21.650\dots \\ 12.5 \end{bmatrix} = \begin{bmatrix} 21.7 \\ 12.5 \end{bmatrix} \leftarrow 1 \text{ d.p.}$$

$$(b) \mathbf{F} + \begin{bmatrix} 21.650\dots \\ 12.5 \end{bmatrix} + \begin{bmatrix} -20 \cos 45^\circ \\ 20 \sin 45^\circ \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

$$\therefore \mathbf{F} = \begin{bmatrix} 0 + 20 \times \cos 45^\circ - 21.650\dots \\ 0 - 20 \times \sin 45^\circ - 12.5 \end{bmatrix}$$

$$\mathbf{F} = \begin{bmatrix} -7.5078\dots \\ -26.642\dots \end{bmatrix}$$

$$\mathbf{F} = \begin{bmatrix} -7.51 \\ -26.6 \end{bmatrix} \text{ (3 s.f.)}$$

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