Solutionbank M1

Heinemann Modular Maths for Edexcel AS and A-level

4 Forces

Exercise E, Question 21

Question:

Four boys are playing a 'tug of war' game, each pulling horizontally on a rope attached to a light ring. Boy A pulls with a force of $(92\mathbf{i} - 33\mathbf{j})$ N, boy B with force $(66\mathbf{i} + 62\mathbf{j})$ N and boy C with force $(-70\mathbf{i} + 99\mathbf{j})$ N, where **i** and **j** are perpendicular unit vectors. Given that the ring is in equilibrium, find the force exerted by boy D, and its magnitude.

Solution:

$$\mathbf{F}_D + (92\mathbf{i} - 33\mathbf{j}) + (66\mathbf{i} + 62\mathbf{j}) + (-70\mathbf{i} + 99\mathbf{j}) = 0\mathbf{i} + 0\mathbf{j}$$

$$\therefore \mathbf{F}_D = (0 - 92 - 66 + 70)\mathbf{i} + (0 + 33 - 62 - 99)\mathbf{j}$$

$$\text{i.e. } \mathbf{F}_D = -88\mathbf{i} - 128\mathbf{j}$$

$$\text{and } |\mathbf{F}_D| = \sqrt{88^2 + 128^2}$$

$$|\mathbf{F}_D| = 155.33...$$

$$|\mathbf{F}_D| = 155 \text{ N (3 s.f.)}$$