

# 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  $\mathbf{i}$  and  $\mathbf{j}$  are perpendicular unit vectors. Given that the ring is in equilibrium, find the force exerted by boy D, and its magnitude.

#### Solution:

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

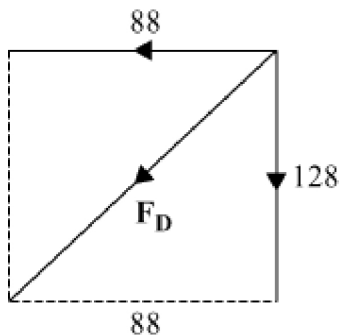
$$\therefore F_D = (0 - 92 - 66 + 70)\mathbf{i} + (0 + 33 - 62 - 99)\mathbf{j}$$

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

$$\text{and } |F_D| = \sqrt{88^2 + 128^2}$$

$$|F_D| = 155.33\dots$$

$$|F_D| = 155 \text{ N (3 s.f.)}$$



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