

Solutionbank M1

Heinemann Modular Maths for Edexcel AS and A-level

4 Forces

Exercise E, Question 12

Question:

A particle of weight 10 N is suspended by two light, inextensible strings. The tension in one string is 5 N, which acts at 20° to the vertical. Find the tension in the second string and the angle between it and the vertical.

Solution:

Since the particle is in equilibrium

$$\mathbf{T} + (-5 \sin 20^\circ \mathbf{i} + 5 \cos 20^\circ \mathbf{j}) + (-10\mathbf{j}) = \mathbf{0}$$

$$\therefore \mathbf{T} = 5 \sin 20^\circ \mathbf{i} + (10 - 5 \cos 20^\circ) \mathbf{j}$$

$$\text{i.e. } \mathbf{T} = 1.7101\mathbf{i} + 5.3015\mathbf{j}$$

$$\therefore |\mathbf{T}| = \sqrt{1.7101^2 + 5.3015^2}$$

$$|\mathbf{T}| = 5.5705$$

$$|\mathbf{T}| = 5.57 \text{ N (3 s.f.)}$$

$$\text{and } \tan \alpha = \frac{1.7101\dots}{5.3015\dots}$$

$$\alpha = 17.877\dots^\circ$$

i.e. at 17.9° (3 s.f.) with the vertical

