

Solutionbank M1

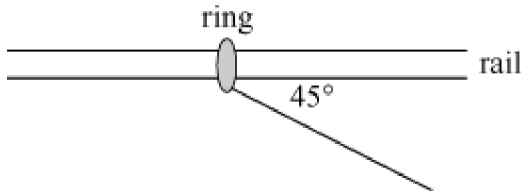
Heinemann Modular Maths for Edexcel AS and A-level

4 Forces

Exercise F, Question 8

Question:

A small ring, of weight w N, is threaded on a horizontal curtain rail. A light, inextensible string is pulling it along the rail. The tension in the string is equal to $2w$ N. Show that the least value of the coefficient of friction is 0.586, correct to three decimal places.



Solution:

Resolving horizontally

$$F = 2w \cos 45^\circ$$

Resolving vertically

$$R = w + 2w \sin 45^\circ$$

Limiting friction

$$F = \mu R$$

$$\therefore 2w \cos 45^\circ = \mu [w + 2w \sin 45^\circ]$$

$$\therefore \frac{2w \cos 45^\circ}{w (1 + 2 \sin 45^\circ)} = \mu \quad (\text{cancel by } w)$$

$$\mu = \frac{2 \cos 45^\circ}{(1 + 2 \sin 45^\circ)}$$

$$\mu = 0.58578\dots$$

$$\mu = 0.586 \quad (3 \text{ s.f.})$$

