6:

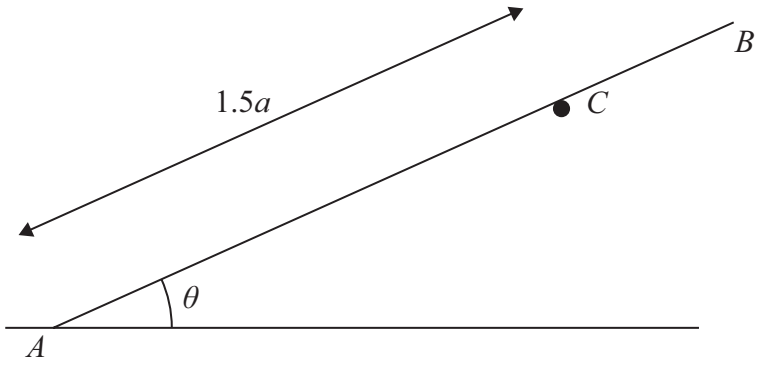


Figure 2

A uniform rod AB, of mass m and length $2a$, has its end A on a rough horizontal floor.

A smooth horizontal rail is fixed above the floor.

The rod rests in equilibrium against the rail at the point C, where $AC = 1.5a$.

The vertical plane containing the rod is at right angles to the rail.

The rod is inclined to the floor at an angle θ, as shown in Figure 2.

The magnitude of the normal reaction exerted on the rod at C is S.

(a) Show that $S = \dfrac{2mg\cos\theta}{3}$

(3)

The magnitude of the vertical component of the force exerted on the rod at A is V.

(b) Show that $V = \dfrac{mg}{3}(3 - 2\cos^2\theta)$

(3)

Given that the rod is in limiting equilibrium and the coefficient of friction between the rod and the floor is $\dfrac{4}{7}$

(c) show that

$$p\tan^2\theta + q\tan\theta + r = 0$$

where p, q and r are integers to be found.

(6)

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Question 6 continued

(Total for Question 6 is 12 marks)