3.

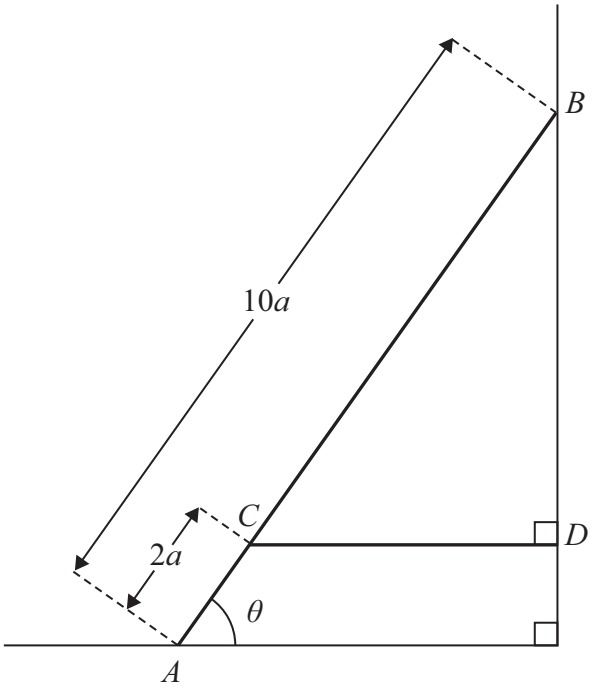


Figure 2

A uniform rod AB has mass m and length $10a$.

The end A is on smooth horizontal ground and the end B is against a smooth vertical wall.

To prevent the rod from slipping, one end of a light inextensible string is attached to the rod at the point C, where $AC = 2a$

The other end of the string is attached to the wall at the point D.

The string is parallel to the ground and in the same vertical plane as the rod.

The rod is in equilibrium in a vertical plane perpendicular to the wall.

The rod is inclined at an angle θ to the horizontal, as shown in Figure 2, where $0 < \theta < 90°$

The tension in the string is T.

(a) Show that

$$\tan\theta = \frac{5mg}{8T}$$

(4)

A particle of mass $3m$ is now attached to a point E on the rod and the rod remains in equilibrium.

Given that the maximum tension in the string before breaking is $2mg$ and $\tan\theta = \frac{4}{3}$

(b) find the maximum distance AE.

(5)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Question 3 continued

Question 3 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Question 3 continued

(Total for Question 3 is 9 marks)