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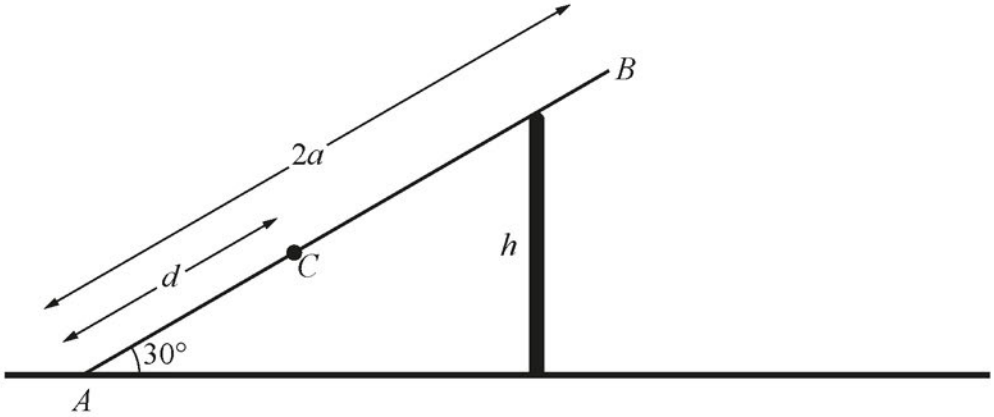

The diagram shows a ladder AB, of length $2a$ and mass m, resting in equilibrium on a vertical wall of height h. The ladder is inclined at an angle of 30° to the horizontal. The end A is in contact with horizontal ground. An object of mass $2m$ is placed on the ladder at a point C where $AC = d$.

The ladder is modelled as uniform, the ground is modelled as being rough, and the vertical wall is modelled as being smooth.

(a) Show that the normal contact force between the ladder and the wall is $\dfrac{mg(a+2d)\sqrt{3}}{4h}$. **[4]**

It is given that the equilibrium is limiting and the coefficient of friction between the ladder and the ground is $\frac{1}{8}\sqrt{3}$.

(b) Show that $h = k(a+2d)$, where k is a constant to be determined. **[7]**

(c) Hence find, in terms of a, the greatest possible value of d. **[2]**

(d) State one improvement that could be made to the model. **[1]**