A#60 LADDER PROBLEMS (not for AQA students)

AEM questions are taken from past exam papers - they have been carefully chosen to represent a typical exam question at each level of difficulty. If you can do these questions, you're ready to move onto past papers for this topic.

APPRENTICE

A uniform ladder, of weight W, rests with its top against a rough vertical wall and its base on rough horizontal ground.

The coefficient of friction between the wall and the ladder is μ and the coefficient of friction between the ground and the ladder is 2μ. When the ladder is on the point of slipping, the ladder is inclined at an angle of $\dfrac{\pi}{4}$ to the horizontal.

a. Draw a diagram to show the forces acting on the ladder.

b. Find the value of μ.

EXPERT

A uniform ladder AB of weight $W\,\mathrm{N}$ and length $4\mathrm{m}$ rests with its end A on rough horizontal ground and its end B against a smooth vertical wall. The ladder is inclined at an angle θ to the horizontal where $\tan\theta = \dfrac{1}{2}$ (see diagram). A small object S of weight $2W\,\mathrm{N}$ is placed on the ladder at a point C, which is $1\mathrm{m}$ from A. The coefficient of friction between the ladder and the ground is μ and the system is in limiting equilibrium.

a. Show that $\mu = \dfrac{2}{3}$.

A small object of weight $aW\,\mathrm{N}$ is placed on the ladder at its mid-point and the object S of weight $2W\,\mathrm{N}$ is placed on the ladder at its lowest point A.

b. Given that the system is in equilibrium, find the set of possible values of a.
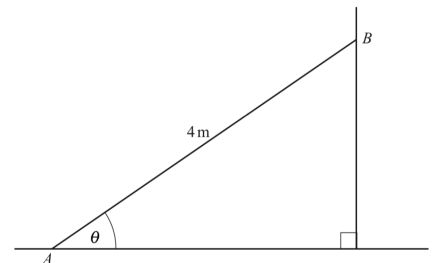
MASTER

A uniform ladder AB, of length 6 metres and mass $22\mathrm{kg}$, rests with its foot, A, on rough horizontal ground. The ladder rests against the top of a smooth vertical wall at the point C, where the length AC is 5 metres. The vertical plane containing the ladder is perpendicular to the wall, and the angle between the ladder and the ground is $60°$. A man, of mass $88\mathrm{kg}$, is standing on the ladder.

The man may be modelled as a particle at the point D.
The length of AD is 4 metres.
The ladder is on the point of slipping

a. Draw a diagram to show the forces acting on the ladder.

b. Find the coefficient of friction between the ladder and the horizontal ground.