

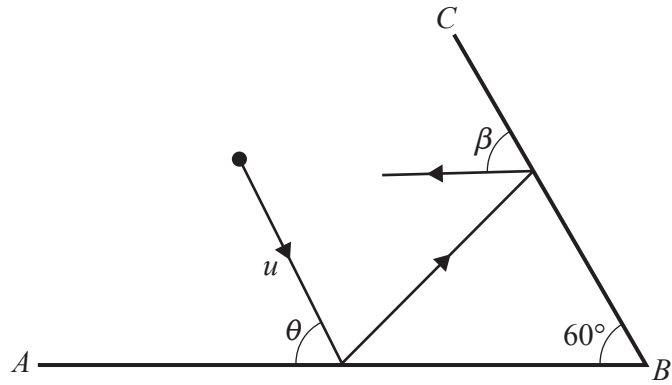
Dotted lines for writing.

(b) Find the value of $\cos \alpha$. [2]

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6



AB and BC are two fixed smooth vertical barriers on a smooth horizontal surface, with angle $ABC = 60^\circ$. A particle of mass m is moving with speed u on the surface. The particle strikes AB at an angle θ with AB . It then strikes BC and rebounds at an angle β with BC (see diagram). The coefficient of restitution between the particle and each barrier is e and $\tan \theta = 2$.

The kinetic energy of the particle after the first collision is 40% of its kinetic energy before the first collision.

(a) Find the value of e . [4]

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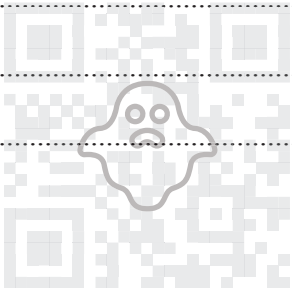
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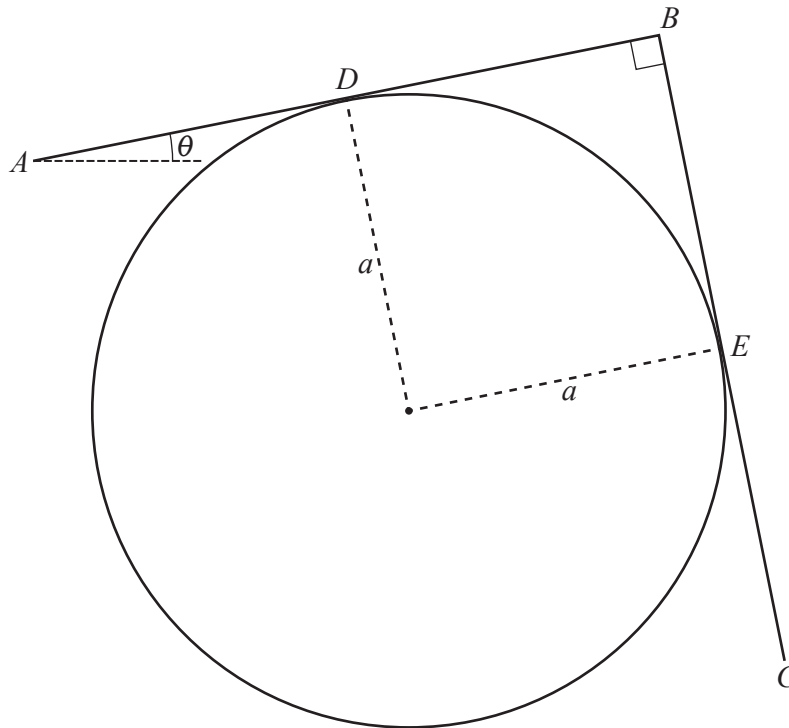
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A uniform cylinder with a rough surface and of radius a is fixed with its axis horizontal. Two identical uniform rods AB and BC , each of weight W and length $2a$, are rigidly joined at B with AB perpendicular to BC . The rods rest on the cylinder in a vertical plane perpendicular to the axis of the cylinder with AB at an angle θ to the horizontal. D and E are the midpoints of AB and BC respectively and also the points of contact of the rods with the cylinder (see diagram). The rods are about to slip in a clockwise direction. The coefficient of friction between each rod and the cylinder is μ .

The normal reaction between AB and the cylinder is R and the normal reaction between BC and the cylinder is N .

- (a) Find the ratio $R : N$ in terms of μ . [6]

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(b) Given that $\mu = \frac{1}{3}$, find the value of $\tan \theta$. [3]

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