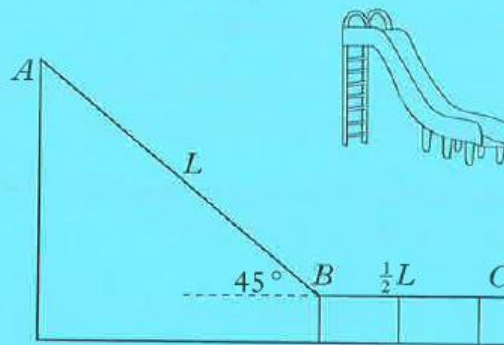


Homework 7

- 1) The coefficient of friction between a body of mass 4 kg and a plane surface is 0.2. The plane surface is inclined at an angle to the horizontal so that the body is on the point of slipping **down** the plane. With the plane still inclined at this angle, a force is now applied to the body, acting up the line of greatest slope of the plane. Given that the body is then on the point of moving **up** the plane, calculate the magnitude of this applied force.

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- 2) The diagram below shows a slide in a playground. The section AB of the chute has length L metres and is inclined at an angle of 45° to the horizontal, whereas section BC is horizontal and has length $\frac{1}{2}L$ metres.



Starting from rest, Jill slides down the chute from A to C . Over both sections of the chute a frictional force acts on Jill where the coefficient of friction between her and the chute is $\frac{1}{2}$.

- (a) Find the speed of Jill at the point B .
- (b) Assuming that there is no change of speed as Jill moves from the sloping part of the slide to its horizontal part, show that her speed at C is given by

$$\sqrt{\frac{gL(\sqrt{2}-1)}{2}} \text{ m s}^{-1},$$

where $g \text{ m s}^{-2}$ is the magnitude of the acceleration due to gravity.

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3) A cargo boat leaves the harbour at 11am and travels due north at a speed of U kilometres per hour. At the same time a ferry is 10 kilometres east of the harbour and is travelling at $2\sqrt{2}U$ kilometres per hour on a bearing of 315° .

a) Taking the harbour as the origin find the position of the ferry boat relative to the cargo boat in terms of t , where t is the time in hours.

(4)

b) Show that the minimum distance between the ferry and the cargo boat is $2\sqrt{5}$ kilometres.

(5)

4)

Express $y = \frac{4x-3}{x(x^2+3)}$, $x \neq 0$, in partial fractions.