

4.

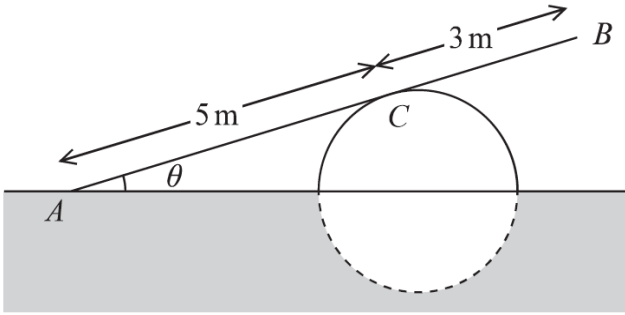


Figure 2

A ramp, AB , of length 8 m and mass 20 kg, rests in equilibrium with the end A on rough horizontal ground.

The ramp rests on a smooth solid cylindrical drum which is partly under the ground. The drum is fixed with its axis at the same horizontal level as A .

The point of contact between the ramp and the drum is C , where $AC = 5$ m, as shown in Figure 2. The distance from the point of contact to the end of the ramp is $CB = 3$ m.

The ramp is resting in a vertical plane which is perpendicular to the axis of the drum, at an angle θ to the horizontal, where $\tan \theta = \frac{5}{12}$

The ramp is modelled as a uniform rod.

- (a) Explain why the reaction from the drum on the ramp at point C acts in a direction which is perpendicular to the ramp. (1)
- (b) Find the magnitude of the resultant force acting on the ramp at A . (9)

The ramp is still in equilibrium in the position shown in Figure 2 but the ramp is not now modelled as being uniform.

Given that the centre of mass of the ramp is assumed to be closer to A than to B ,

- (c) state how this would affect the magnitude of the normal reaction between the ramp and the drum at C . (1)

(Total for Question 4 is 11 marks)