

Figure 1

A small box of mass 3 kg moves on a rough plane which is inclined at an angle of 20° to the horizontal. The box is pulled up a line of greatest slope of the plane using a rope which is attached to the box. The rope makes an angle of 30° with the plane, as shown in Figure 1. The rope lies in the vertical plane which contains a line of greatest slope of the plane. The coefficient of friction between the box and the plane is 0.3. The tension in the rope is 25 N.

The box is modelled as a particle, the rope is modelled as a light inextensible string and air resistance is ignored.

Using the model,

- (a) find the acceleration of the box.
- (b) Suggest one improvement to the model that would make it more realistic.

(1)

(7)

The rope now breaks and the box slows down and comes to rest.

(c) Show that, after the box comes to rest, it immediately starts to move down the plane.

(3)

(Total 11 marks)