2 A uniform square box with sides 0.80 m and mass 2.0 kg is at rest on the ground. One end of a light rope is attached to the box and the other end is attached to the wheel of a motor. The motor applies a constant clockwise torque of 5.0 N m on the wheel of radius 0.20 m.

At the instant shown in Fig. 2.1, the rope is taut and it makes an angle of $\theta = 20°$ with the vertical side of the box. The system remains in equilibrium.

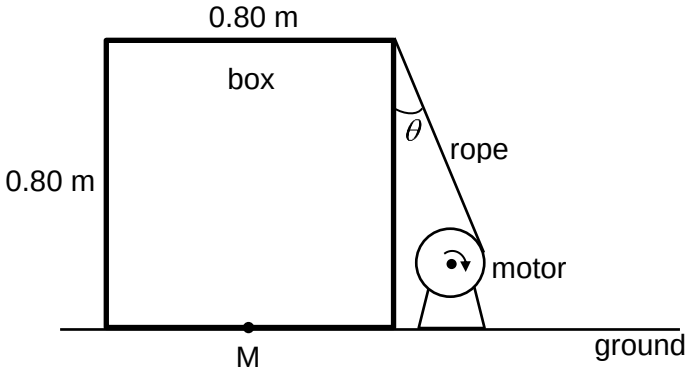

Fig. 2.1

(a) Calculate the tension in the rope.

tension = ... N [1]

(b) Point M is the mid-point at the base of the box as shown in Fig. 2.1.

By taking moments about point M, determine the horizontal distance *d* between M and the point at which the contact force by the ground acts on the box.

d = ... m [3]

(c) The motor is shifted to the right such that θ increases. The torque applied by the motor remains constant.

Without any further calculations, explain why there is a maximum value of θ for which equilibrium can be maintained.

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..... [1]