

# Solutionbank M1

Heinemann Modular Maths for Edexcel AS and A-level

## Exam style practice papers

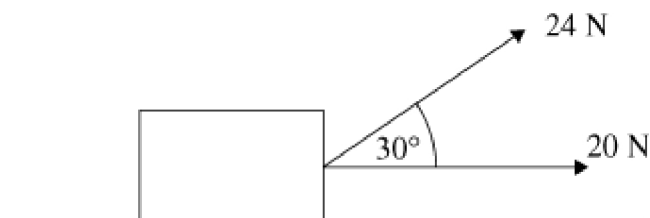
### Exercise MM1A, Question 3

#### Question:

A box of mass 20 kg is at rest on a rough horizontal surface. Two ropes are attached to the box and exert forces as shown in the diagram.

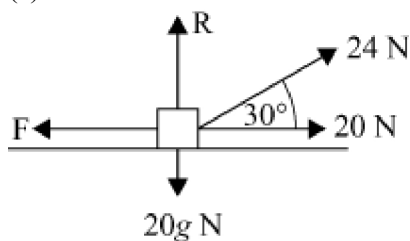
Model the box as a particle.

- (a) Draw a diagram to show all of the forces acting on the box. (1 mark)
- (b) Show that the magnitude of the normal reaction force acting on the box is 184 N. (3 marks)
- (c) Calculate the magnitude of the friction force acting on the box. (2 marks)
- (d) The coefficient of friction between the box and the surface is  $\mu$ . Find an inequality that  $\mu$  must satisfy. (3 marks)



#### Solution:

(a)



$$\text{Resolve vertically } R + 24 \sin 30^\circ = 20g$$

$$(b) \therefore R = 184$$

Magnitude of normal reaction force is 184 N .

$$\text{Resolve horizontally } F = 20 + 24 \cos 30^\circ$$

$$(c) = 40.78$$

Magnitude of friction force is 40.8 N .

(d) Particle is stationary,

$$\begin{aligned}\text{thus } F &\leq \mu R \\ 40.78 &\leq 184\mu \\ \mu &\geq \frac{40.78}{184} \\ \mu &\geq 0.2216 \\ \therefore \mu &\geq 0.222\end{aligned}$$

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