2.

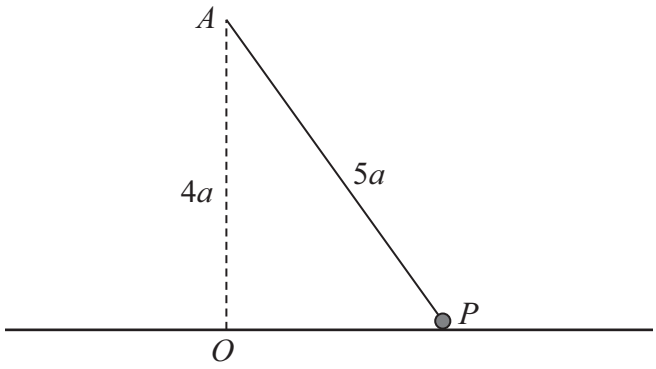


Figure 1

A particle P of mass m is attached to one end of a light inextensible string of length $5a$
The other end of the string is attached to a fixed point A above a smooth horizontal table.
The particle moves in a horizontal circle on the table with the string taut.
The centre O of the circle is vertically below A with $OA = 4a$, as shown in Figure 1.

The particle moves with constant angular speed ω and remains in contact with the table.

(a) Find, in terms of m and g, the magnitude of the normal reaction between P and the table when $\omega = \frac{1}{4}\sqrt{\frac{g}{a}}$

(6)

The angular speed ω is gradually increased and the particle remains in contact with the table.

(b) Show that $\omega < \frac{1}{2}\sqrt{\frac{g}{a}}$

(2)

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Question 2 continued

(Total for Question 2 is 8 marks)