

- 6 One end of a light elastic string, of natural length  $a$  and modulus of elasticity  $k$ , is attached to a particle  $P$  of mass  $m$ . The other end of the string is attached to a fixed point  $Q$ . The particle  $P$  is projected vertically upwards from  $Q$ . When  $P$  is moving upwards and at a distance  $\frac{4}{3}a$  directly above  $Q$ , it has a speed  $\sqrt{2ga}$ . At this point, its acceleration is  $\frac{7}{3}g$  downwards.

Show that  $k = 4mg$  and find in terms of  $a$  the greatest height above  $Q$  reached by  $P$ . [8]

This image shows a full page of white paper with horizontal dashed lines, typical of primary-ruled notebook paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.