

- 4 A uniform rod  $AB$  of length  $4a$  and weight  $W$  is smoothly hinged to a vertical wall at the end  $A$ . The rod is held at an angle  $\theta$  above the horizontal by a light elastic string. One end of the string is attached to the point  $C$  on the rod, where  $AC = 3a$ . The other end of the string is attached to a point  $D$  on the wall, with  $D$  vertically above  $A$  and such that angle  $ACD = 2\theta$ . A particle of weight  $\frac{1}{2}W$  is attached to the rod at  $B$ . It is given that  $\tan \theta = \frac{8}{15}$ .

(i) Show that the tension in the string is  $\frac{17}{12}W$ . [4]

This image shows a single page of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

(ii) Find the magnitude and direction of the reaction at the hinge.

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(iii) Given that the natural length of the string is  $2a$ , find its modulus of elasticity.

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