



A uniform rod  $AB$  of length  $3a$  and weight  $W$  is freely hinged to a fixed point at the end  $A$ . The end  $B$  is below the level of  $A$  and is attached to one end of a light elastic string of natural length  $4a$ . The other end of the string is attached to a point  $O$  on a vertical wall. The horizontal distance between  $A$  and the wall is  $5a$ . The string and the rod make angles  $\theta$  and  $2\theta$  respectively with the horizontal (see diagram). The system is in equilibrium with the rod and the string in the same vertical plane. It is given that  $\sin \theta = \frac{3}{5}$  and you may use the fact that  $\cos 2\theta = \frac{7}{25}$ .

- (i) Find the tension in the string in terms of  $W$ . [3]
- (ii) Find the modulus of elasticity of the string in terms of  $W$ . [4]
- (iii) Find the angle that the force acting on the rod at  $A$  makes with the horizontal. [3]