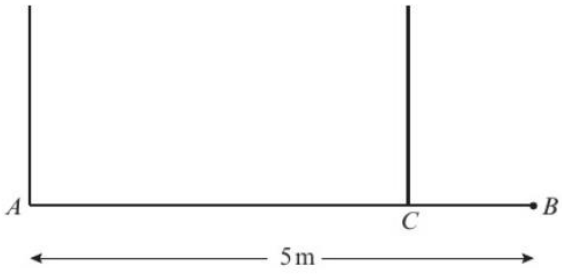
(P) **6** A uniform rod AB, of length 4 m and weight 20 N, is suspended horizontally by two vertical strings attached at A and at B. A particle of weight 10 N is attached to the rod at point C, where $AC = 1.5$ m.

a Find the magnitudes of the tensions in the two strings.

The particle is moved so that the rod remains in horizontal equilibrium with the tension in the string at B 1.5 times the tension in the string at A.

b Find the new distance of the particle from A.

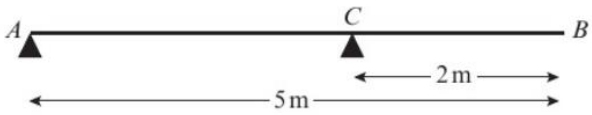
(E/P) **7** A uniform beam AB, of length 5 m and mass 60 kg, has a load of 40 kg attached at B. It is then held horizontally in equilibrium by two vertical wires attached at A and C. The tension in the wire at C is four times the tension in the wire at A. By modelling the beam as a uniform rod and the load as a particle, calculate:



a the tension in the wire at C **(2 marks)**

b the distance CB. **(5 marks)**

(E) **8** A uniform plank AB has length 5 m and mass 15 kg. The plank is held in equilibrium horizontally by two smooth supports A and C as shown in the diagram, where $BC = 2$ m.

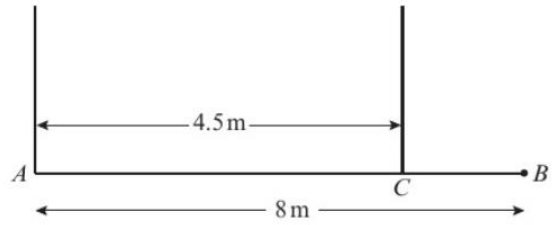


a Find the reaction on the plank at C. **(3 marks)**

A person of mass 45 kg stands on the plank at the point D and it remains in equilibrium. The reactions on the plank at A and C are now equal.

b Find the distance AD. **(7 marks)**

(E/P) **9** A uniform beam AB has weight W N and length 8 m. The beam is held in a horizontal position in equilibrium by two vertical light inextensible wires attached to the beam at the points A and C where $AC = 4.5$ m, as shown in the diagram. A particle of weight 30 N is attached to the beam at B.



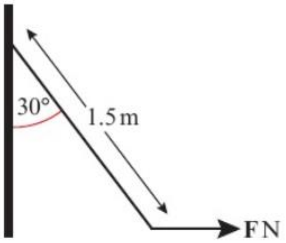
a Show that the tension in the wire attached to the beam at C is $\left(\frac{8}{9}W + \frac{160}{3}\right)$ N. **(4 marks)**

b Find, in terms of W, the tension in the wire attached to the beam at A. **(3 marks)**

Given that the tension in the wire attached to the beam at C is twelve times the tension in the wire attached to the beam at A,

c find the value of W. **(3 marks)**

(E/P) **10** A metal lever of mass 5 kg and length 1.5 m is attached by a smooth hinge to a vertical wall. The lever is held at an angle of 30° to the vertical by a horizontal force of magnitude **F** N applied at the other end of the lever. By modelling the lever as a uniform rod, find the value of **F**. **(4 marks)**



6 **a** 16.25 N, 13.75 N **b** 3.2 m

7 **a** 784 N **b** 0.625 m

8 **a** 122.5 N **b** 1.17 m

9 **a** $\frac{9}{2}T_C = 4W + 8 \times 30$

$\frac{9}{2}T_C = 4W + 240$

$9T_C = 8W + 480$

$T_C = \frac{8}{9}W + \frac{160}{3}$

b $T_A = \frac{W}{9} - \frac{70}{3}$ **c** 750 N

10 14.1 N