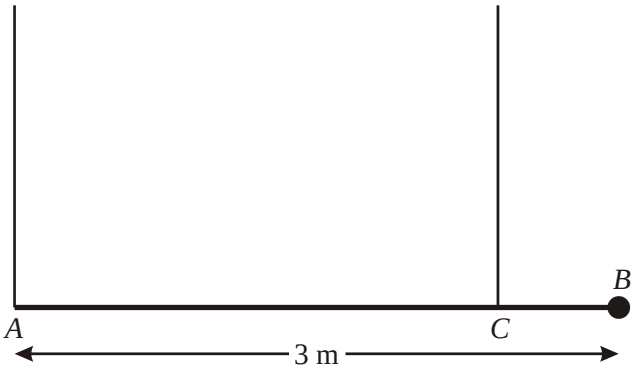
Year 2 Applied Chapter 4: Moments - Exam Questions (Total Marks 59)

1.



A plank *AB* has mass 40 kg and length 3 m. A load of mass 20 kg is attached to the plank at *B*. The loaded plank is held in equilibrium, with *AB* horizontal, by two vertical ropes attached at *A* and *C*, as shown in the diagram. The plank is modelled as a uniform rod and the load as a particle. Given that the tension in the rope at *C* is three times the tension in the rope at *A*, calculate

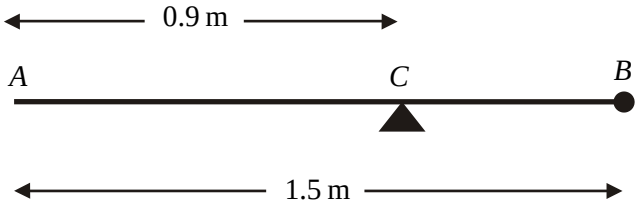
(a) the tension in the rope at *C*,

(2)

(b) the distance *CB*.

(5)
(Total 7 marks)

2.



A uniform rod *AB* has length 1.5 m and mass 8 kg. A particle of mass *m* kg is attached to the rod at *B*. The rod is supported at the point *C*, where *AC* = 0.9 m, and the system is in equilibrium with *AB* horizontal, as shown in the diagram above.

(a) Show that $m = 2$.

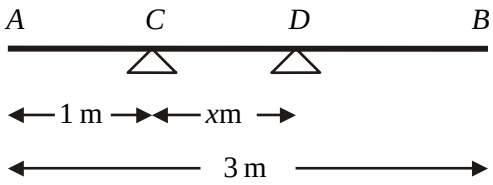
(4)

A particle of mass 5 kg is now attached to the rod at *A* and the support is moved from *C* to a point *D* of the rod. The system, including both particles, is again in equilibrium with *AB* horizontal.

(b) Find the distance *AD*.

(5)
(Total 9 marks)

3.



A uniform plank AB has weight 120 N and length 3 m. The plank rests horizontally in equilibrium on two smooth supports C and D, where $AC = 1$ m and $CD = x$ m, as shown in the diagram above. The reaction of the support on the plank at D has magnitude 80 N. Modelling the plank as a rod,

(a) show that $x = 0.75$

(3)

A rock is now placed at B and the plank is on the point of tilting about D.
Modelling the rock as a particle, find

(b) the weight of the rock,

(4)

(c) the magnitude of the reaction of the support on the plank at D.

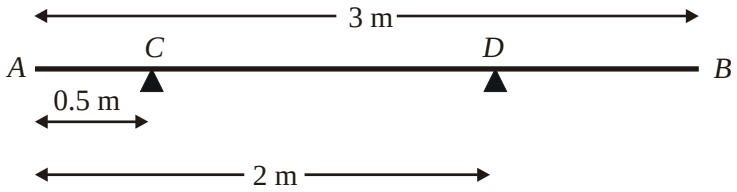
(2)

(d) State how you have used the model of the rock as a particle.

(1)

(Total 10 marks)

4.



A uniform rod AB has length 3 m and weight 120 N. The rod rests in equilibrium in a horizontal position, smoothly supported at points C and D, where $AC = 0.5$ m and $AD = 2$ m, as shown in the diagram above. A particle of weight W newtons is attached to the rod at a point E where $AE = x$ metres. The rod remains in equilibrium and the magnitude of the reaction at C is now twice the magnitude of the reaction at D.

(a) Show that $W = \dfrac{60}{1 - x}$.

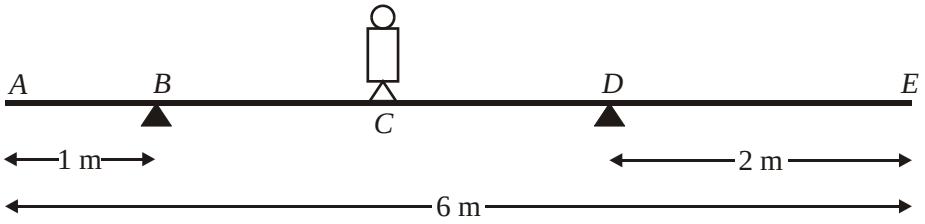
(8)

(b) Hence deduce the range of possible values of x.

(2)

(Total 10 marks)

5.



A plank *AE*, of length 6 m and mass 10 kg, rests in a horizontal position on supports at *B* and *D*, where *AB* = 1 m and *DE* = 2 m. A child of mass 20 kg stands at *C*, the mid-point of *BD*, as shown in the diagram above. The child is modelled as a particle and the plank as a uniform rod. The child and the plank are in equilibrium. Calculate

(a) the magnitude of the force exerted by the support on the plank at *B*,

(4)

(b) the magnitude of the force exerted by the support on the plank at *D*.

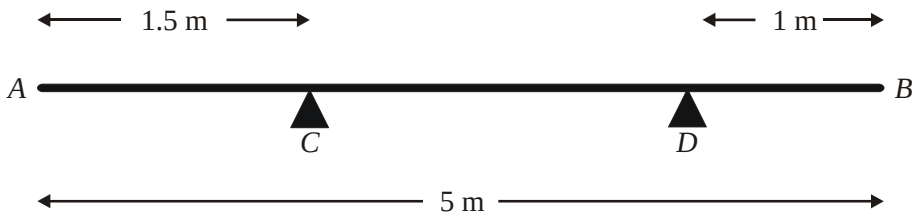
(3)

The child now stands at a point *F* on the plank. The plank is in equilibrium and on the point of tilting about *D*.

(c) Calculate the distance *DF*.

(4)
(Total 11 marks)

6.



A non-uniform rod AB has length 5 m and weight 200 N. The rod rests horizontally in equilibrium on two smooth supports C and D, where AC = 1.5 m and DB = 1 m, as shown in the diagram above. The centre of mass of AB is x metres from A. A particle of weight W newtons is placed on the rod at A. The rod remains in equilibrium and the magnitude of the reaction of C on the rod is 160 N.

(a) Show that $50x - W = 100$.

(5)

The particle is now removed from A and placed on the rod at B. The rod remains in equilibrium and the reaction of C on the rod now has magnitude 50 N.

(b) Obtain another equation connecting W and x.

(3)

(c) Calculate the value of x and the value of W.

(4)

(Total 12 marks)