MOMENTS 3

1. The diagram shows a uniform plank XY, of mass 40 kg and length 3 m, resting on two supports at P and Q, where $XP = 0{\cdot}7$ m, and $QY = 0{\cdot}9$ m.

A boy A, of mass 45 kg, sits on the plank at the point P and a boy B, of mass 70 kg, sits on the plank at the end Y.

(a) Modelling the boys as particles, calculate the magnitudes of the normal reactions of the supports on the plank. [6]

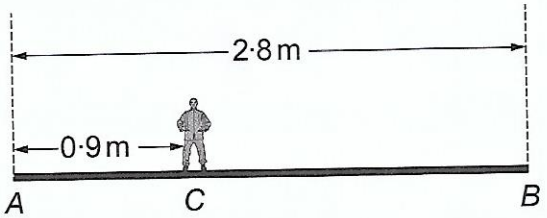
(b) State what would happen if A jumps off the plank. Give a reason for your answer. [2]

2. The diagram shows a **non-uniform** rod AB, of length 6 m and mass 40 kg, resting horizontally in equilibrium on two smooth supports at P and Q, which are respectively 2·5 m and 5·5 m from A. The point C is the position of the centre of mass of the rod and $AC = x$ m. The forces exerted on the rod by the supports at P and Q are **equal** in magnitude.

(a) Find the magnitude of each of the forces exerted on the rod by the supports at P and Q. [2]

(b) Calculate the value of x. [4]

3. The diagram shows a plank AB, of mass 15 kg and length 2·8 m, being held in equilibrium with AB horizontal by means of two vertical ropes, one attached to the end A and the other attached to the end B. A man of mass 80 kg stands on the plank at point C, where $AC = 0{\cdot}9$ m.



(a) Modelling the plank as a uniform rod, find the tensions in the ropes attached to the end A and the end B of the plank. [7]

(b) The plank is now modelled as a **non-uniform** rod. Given that the tension in the rope attached to A is 1·5 times the tension in the rope attached to B, determine the distance of the centre of mass of the plank from A. [5]