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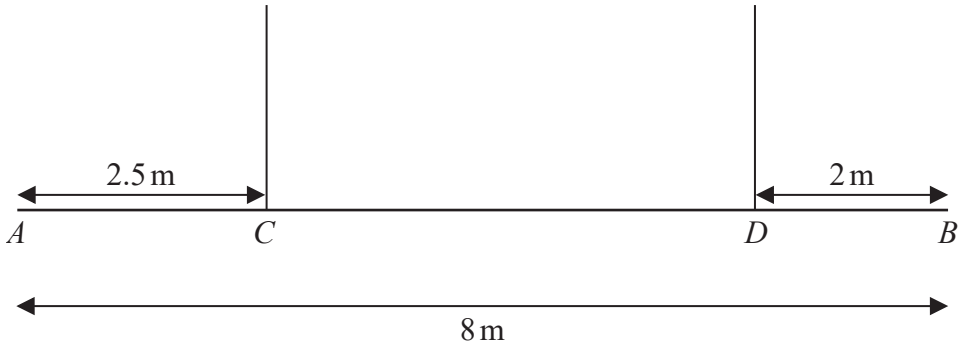


Figure 2

A non-uniform beam AB has length 8 m and mass M kg.

The centre of mass of the beam is d metres from A.

The beam is supported in equilibrium in a horizontal position by two vertical light ropes. One rope is attached to the beam at C, where $AC = 2.5$ m and the other rope is attached to the beam at D, where $DB = 2$ m, as shown in Figure 2.

A gymnast, of mass 64 kg, stands on the beam at the point X, where $AX = 1.875$ m, and the beam remains in equilibrium in a horizontal position but is now on the point of tilting about C.

The gymnast then dismounts from the beam.

A second gymnast, of mass 48 kg, now stands on the beam at the point Y, where $YB = 0.5$ m, and the beam remains in equilibrium in a horizontal position but is now on the point of tilting about D.

The beam is modelled as a non-uniform rod and the gymnasts are modelled as particles.

Find the value of M.

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