6.

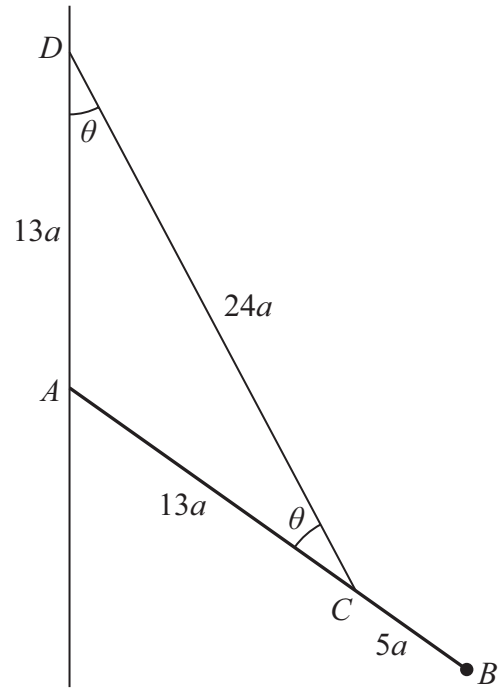


Figure 3

A **non-uniform** pole AB has length $18a$.
The end A of the pole is freely hinged to a fixed point on a vertical wall.
One end of a cable of length $24a$ is attached to the pole at the point C, where $AC = 13a$.
The other end of the cable is attached to the wall at the point D, where D is above A and $AD = 13a$.
Angle ADC = Angle $ACD = \theta$
A particle is attached to the pole at B, as shown in Figure 3.

The pole rests in equilibrium in a vertical plane that is perpendicular to the wall.

The pole is modelled as a non-uniform rod and the cable is modelled as being light and inextensible.

Given that

- the weight of the pole is W
- the weight of the particle is $\frac{1}{3}W$
- the tension in the cable is $\frac{6}{5}W$

use the model to,

(a) find, in terms of a, the exact distance of the centre of mass of AB from A.

(4)

(b) find, in terms of W, the magnitude of the resultant force exerted on the rod by the hinge at A.

(6)

(Total for Question 6 is 10 marks)