5.

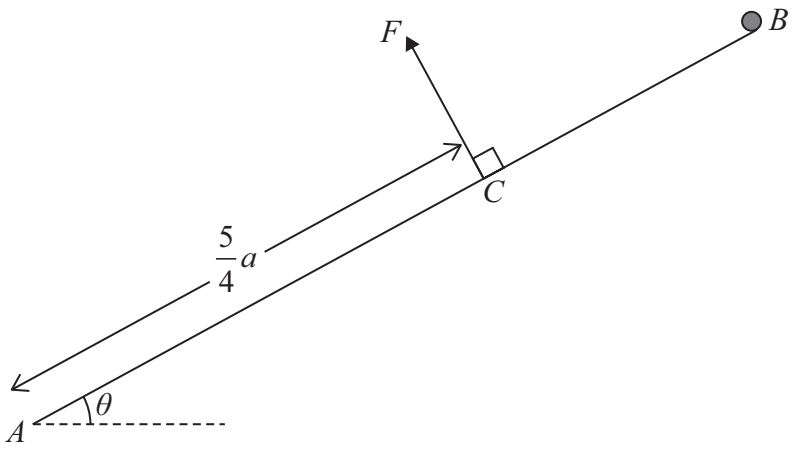


Figure 2

A uniform rod AB, of mass m and length $2a$, is freely hinged to a fixed point A.

A particle of mass km is fixed to the rod at B.

The rod is held in equilibrium, at an angle θ to the horizontal, by a force of magnitude F acting at the point C on the rod, where $AC = \frac{5}{4}a$, as shown in Figure 2.

The line of action of the force at C is at right angles to AB and is in the vertical plane containing AB.

Given that $\tan\theta = \frac{3}{4}$

(a) show that $F = \frac{16}{25}mg(1 + 2k)$

(4)

(b) find, in terms of m, g and k,

(i) the horizontal component of the force exerted by the hinge on the rod at A,

(ii) the vertical component of the force exerted by the hinge on the rod at A.

(5)

Given also that the force acting on the rod at A acts at 45° above the horizontal,

(c) find the value of k.

(3)

(Total for Question 5 is 12 marks)