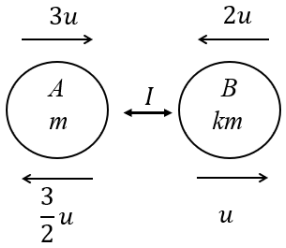
Question Number	Answer	Mark
1(a)		
	CLM	M1
	$3mu - 2kmu = -\frac{3}{2}mu + kmu$	A1
	$k = \frac{3}{2}$	A1
		(3)
1(b)	Impulse equation for A or B	M1
	For A: $\pm m\left(\frac{3u}{2} - -3u\right)$ **OR** For B: $\pm \text{"}\frac{3}{2}\text{"}m\left(u - -2u\right)$	A1ft
	$\frac{9mu}{2}$ oe	A1
		(3)
		(6)
	Notes for Question 1	
1(a)		
M1	CLM: all terms included, dimensionally correct, condone sign errors, allow consistent cancelled m's and consistent extra g's. The mass and speed must be paired correctly and both speeds must be halved.	
A1	Correct unsimplified equation in terms of k (m and u) only.	
A1	Correct answer.	
	S.C. For both speeds to have halved and changed direction, total initial momentum must be zero, so $m \times 3u - km \times 2u = 0$ and hence result.	
1(b)		
M1	Impulse-momentum equation for either particle in terms of m and u. No need to substitute k for the method mark only. Dimensionally correct, condone sign errors. Must correctly pair mass and *their* speeds used in part (a) for the method mark only. M0 if extra g.	
A1ft	Correct unsimplified expression in terms of m and u only. Follow through is **only** for their k value if using B.	

A1	Correct solution only i.e. the answer must be positive and, if $k = \frac{3}{2}$ is used, it must have come from correct working.	

2.

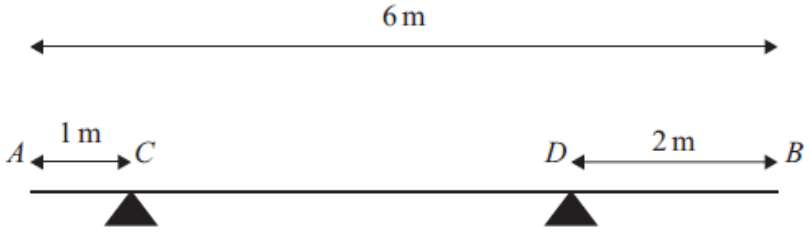


Figure 1

A uniform rod AB has mass 30 kg and length 6 m. The rod rests in equilibrium in a horizontal position on two supports, one at C, where $AC = 1$ m, and the other at D, where $DB = 2$ m, as shown in Figure 1.

A particle of mass 60 kg is placed on the rod at a point which is 2 m from A.

Another particle, whose mass is 75 kg, is placed on the rod at a point that is x metres from B.

The rod remains at rest in equilibrium in a horizontal position.

The magnitude of the force acting on the rod at C is two thirds of the magnitude of the force acting on the rod at D.

(a) Find the magnitude of the force acting on the rod at D.

(3)

(b) Find the exact value of x.

(3)

The particle of mass 75 kg is now removed.

A particle of unknown mass is placed on the rod at B and the rod is now on the point of tilting.

(c) Find the magnitude of the force that is now acting on the rod at D.

(3)