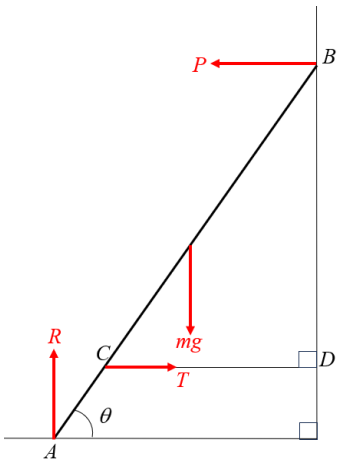
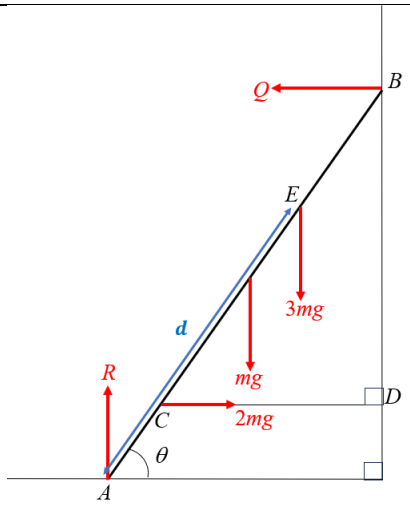
Question number	Scheme	Marks
3		
3(a)	$P = T$ or $R = mg$	B1
	Moments equation	M1
	E.g. M(A) $\left(P \times 10a\sin\theta\right) = \left(mg \times 5a\cos\theta\right) + \left(T \times 2a\sin\theta\right)$ **with *P* and or *R* substituted**	A1
	$\tan\theta = \dfrac{5mg}{8T}$ *	A1*
		(4)
3(b)		
	$Q = 2mg$ or $R = 4mg$	B1
	Moments equation	M1
	e.g. M(A) $\left(Q \times 10a\sin\theta\right) = \left(3mg \times d\cos\theta\right) + \left(mg \times 5a\cos\theta\right) + \left(2mg \times 2a\sin\theta\right)$ Q and/or R do not need to be substituted for **this mark** but $T = 2mg$ does.	A1
	Q and/or R substituted to produce a correct equation in in d, a and (g) only	A1
	$d = 5.4a$ or $5.44a$ (m)	A1
		(5)
		(9)

	Notes for question **NB for the moment equations in this question, ignore the stated centre of the moment and mark the equation.**	
(a)		
B1	Resolves horizontally or vertically	
M1	A complete method to obtain an unsimplified equation in T, m, g and θ (allow a as well) Requires all terms and no extras. Dimensionally correct. Condone sign errors and sin/cos confusion. P and/or R must be substituted	
A1	Correct unsimplified equation in T, m, g and θ Other moments equations include: $[\mathrm{M}(C)]\quad 2aR\cos\theta+3amg\cos\theta=8aP\sin\theta\Rightarrow 2mg+3mg=8aT\tan\theta$ $[\mathrm{M}(G)]\quad 5aR\cos\theta=5aP\sin\theta+3aT\sin\theta$ $[\mathrm{M}(B)]\quad 10aR\cos\theta=5amg\cos\theta+8aT\sin\theta$ $[\mathrm{M}(D)]\quad 8aP\sin\theta+5amg\cos\theta=10R\cos\theta$ $[\mathrm{M}(\text{corner})]\quad 10aR\cos\theta+2aT\sin\theta=5amg\cos\theta+10aP\sin\theta$ $[M(PR\text{ intersect})]\ 8aT\sin\theta=5amg\cos\theta$	
A1*	Obtain given answer from correct working.	
(b)	**N.B. In part (b), allow use of inequalities for first 4 marks but must have equality for final A mark**	
B1	Resolves horizontally or vertically or parallel or perpendicular to rod. Parallel: $R\sin\theta+2mg\sin\theta=mg\sin\theta+3mg\sin\theta+Q\cos\theta$ Perp: $Q\sin\theta+R\cos\theta=2mg\sin\theta+mg\cos\theta+3mg\cos\theta$	
M1	Form a **moments** equation. Requires all terms and no extras. Dimensionally correct. Condone sign errors and sin/cos confusion. T=$2mg$ (and W=mg)must be used for M mark. May be seen later. Other relevant equations include: $[\mathrm{M}(C)]\quad 2aR\cos\theta+3amg\cos\theta+3mg(d-2a)\cos\theta=8aQ\sin\theta$ $[\mathrm{M}(G)]\quad 5aR\cos\theta+3mg(d-5a)\cos\theta=2mg3a\sin\theta+5Qa\sin\theta$ $[\mathrm{M}(E)]\quad dR\cos\theta=2mg(d-2a)\sin\theta+mg(d-5a)\cos\theta+Q(10a-d)\sin\theta$ $[\mathrm{M}(B)]\quad 3mg\times(10a-d)\cos\theta+mg\times5a\cos\theta+2mg\times8a\sin\theta=R\times10a\cos\theta$ $[\mathrm{M}(D)]\quad 10aR\cos\theta+8Qa\sin\theta=5amg\cos\theta+3mg(10a-d)\cos\theta$ $[\mathrm{M}(\text{corner})]\quad 10aR\cos\theta+2mg2a\sin\theta=5amg\cos\theta+3mg(10a-d)\cos\theta+10aQ\sin\theta$ $[\mathrm{M}(PR\text{intersect})]\ 8a\times2mg\sin\theta=5amg\cos\theta+3mgd\cos\theta$	
A1	Correct equation with at most one error, allow Q and R but T must be substituted.	
A1	Correct equation in d, a and (g) only ie Q and/or R must be substituted.	
A1	Correct answer. Accept $5.4a$ or better, exact answer is $\frac{49}{9}a$, $5.444\ldots a$	