Question Number	Solution	Marks	Notes
4a	<table><tr><td></td><td>*ABCD*</td><td>*PQRV*</td><td>*RSTU*</td><td>*L*</td></tr><tr><td>Mass ratio</td><td>64</td><td>4</td><td>16</td><td>44</td></tr><tr><td>c of m from *AD*</td><td>4*a*</td><td>2*a*</td><td>5*a*</td><td>(*d*)</td></tr></table>	B1 B1	Correct mass ratios for their split Correct distances from vertical axis for their split Must be multiples of *a*
	M(*AD*)	M1	Moments about *AD* or a parallel axis. Need all terms and dimensionally consistent.
	$64\times 4a-4\times 2a-16\times 5a=44d$	A1	Correct unsimplified equation Accept as part of a vector equation
	$\Rightarrow d=\frac{168}{44}a=\frac{42}{11}a$ *	A1*	Obtain **given answer** from correct working
		(5)	
4b	C of M of *L* lies at midpt of *AC*	B1	Seen or implied
	M(Mid pt *AB*)	M1	Use of moments to form equation in *k*.
	$\left(4-\frac{42}{11}\right)aM=4akM$	A1	Correct unsimplified equation. Allow with *a* not seen
	$k=\frac{1}{22}$	A1	0.05 or better (0.0454545…) Allow with *a* not seen
		(4)	
4b alt	C of M of *L* lies at midpt of *AC*	B1	Seen or implied by use of $\bar{x}=\bar{y}$ or $\tan 45°=1$
	Find $\bar{x}$ and $\bar{y}$ for system	M1	
	From *AB*: $\frac{42}{11}Ma+8akM=(1+k)M\bar{y}$ From *BC*: $\frac{46}{11}aM=(1+k)M\bar{x}$	A1	Correct unsimplified equations in $\bar{x}$ and $\bar{y}$ Allow with *a* not seen
	$\bar{x}=\bar{y}\Rightarrow\frac{42}{11}+8k=\frac{46}{11}\Rightarrow k=\frac{1}{22}$	A1	Allow with *a* not seen
4b alt	C of M of *L* lies at midpt of *AC*	B1	Seen or implied in moments equation
	If *G* is c of m of *L* then $\tan ABG=\frac{42}{46}$ and take moments about *B*	M1	Complete method for moments about *B*
	$8a\sin 45°\times kM$ $=\frac{Ma\sqrt{46^2+42^2}}{11}\sin(45°-ABG)$	A1	Correct unsimplified equation in *k* Allow with *a* not seen
	$\Rightarrow k=\frac{1}{22}$	A1	Allow with *a* not seen
4b alt	C of M of *L* lies at midpt of *AC*	B1	Seen or implied in moments equation