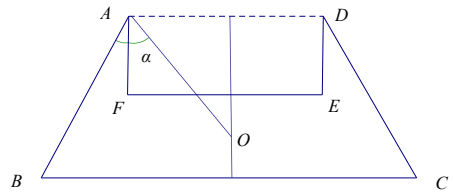
Q	Scheme	Marks	Notes
5a	<table><tr><td></td><td>Mass ratio</td><td>From BC</td></tr><tr><td>Large Δ</td><td>60 (4)</td><td>$4a$</td></tr><tr><td>Small Δ</td><td>15 (1)</td><td>$8a$</td></tr><tr><td>rectangle</td><td>15 (1)</td><td>$4.5a$</td></tr><tr><td>T</td><td>30 (2)</td><td>$\bar{y}$</td></tr></table>	B1 B1	Mass ratios correct Vertical distances correct
	Moments about BC	M1	Or a parallel axis. Signs correct for their split.
	$2\bar{y} = 16a - 8a - 4.5a = \frac{7}{2}a$	A1	Correct unsimplified equation
	$\bar{y} = \frac{7}{4}a$	A1	**Given Answer** Need to see a linear equation in $\bar{y}$
		(5)	
5b			
	$\bar{x} = 5a$ from B	B1	Or equivalent. Seen or implied Might be seen in (a) but needs to be used here.
	$\alpha = \tan^{-1}\left(\frac{\frac{5}{2}a}{6a - \bar{y}}\right)$	M1	Trig ratio of a relevant angle in a triangle involving the c of m
	$\theta = \alpha + \tan^{-1}\frac{5}{12}$	M1	Correct method to find the required angle e.g $\theta = 180° - \tan^{-1}\frac{6}{2.5} - \tan^{-1}\frac{6a - \bar{y}}{2.5a}$
	$= \tan^{-1}\frac{10}{17} + \tan^{-1}\frac{5}{12}$	A1	Correct unsimplified expression for θ seen
			$\tan^{-1}\frac{10}{17} = 30.46..., \tan^{-1}\frac{17}{10} = 59.5..,$ $\tan^{-1}\frac{5}{12} = 22.6.., \tan^{-1}\frac{12}{5} = 67.38...$
	$\theta = 53$	A1	Q asks for a whole number
		(5)	
			See over for alternatives

5balt 1	$\bar{x} = 5a$ from B	B1	Or equivalent. Seen or implied Might be seen in (a) but needs to be used here.
	Correct method to find all 3 sides of a triangle containing θ (or two sides of a right angled triangle containing θ)	M1	e.g.: $BO^2 = (5a)^2 + \left(\frac{7a}{4}\right)^2 = \frac{449}{16}a^2, AB^2 = \frac{169}{4}a^2$ $AO^2 = \left(\frac{5a}{2}\right)^2 + \left(6a - \frac{7a}{4}\right)^2 = \frac{389}{16}a^2$
	Correct method to find the required angle	M1	e.g. $\cos\theta = \frac{AB^2 + AO^2 - OB^2}{2AB.AO}$
	Correct unsimplified expression in θ	A1	$(\cos\theta = 0.60062)$
	$\theta = 53$	A1	Q asks for a whole number
		(5)	
5balt 2	$\bar{x} = 5a$ from B	B1	Or equivalent. Seen or implied Might be seen in (a) but needs to be used here.
	If O is c of m, $\overrightarrow{AB} = \begin{pmatrix} -2.5a \\ -6a \end{pmatrix}$, $\overrightarrow{AO} = \begin{pmatrix} 2.5a \\ -4.25a \end{pmatrix}$	M1	Expressions for $\overrightarrow{AB}$ and $\overrightarrow{AO}$
	Use of scalar product to find $\cos\theta$	M1	
	$\cos\theta = \frac{\overrightarrow{AB}.\overrightarrow{AO}}{\lvert\overrightarrow{AB}\rvert.\lvert\overrightarrow{AO}\rvert}\left(= \frac{-6.25 + 25.5}{\frac{13}{2} \times \frac{\sqrt{389}}{4}}\right)$	A1	Correct unsimplified expression for $\cos\theta$
	$\theta = 53$	A1	Q asks for a whole number
		(5)	
5balt 3	$\bar{x} = 5a$ from B	B1	Or equivalent. Seen or implied Might be seen in (a) but needs to be used here.
	If O is c of m, find coordinates of point of intersection between the line AO and the perpendicular line through B	M1	Relative to B: $A(2.5a, 6a), O(5a, 1.75a)$ $\Rightarrow AO: y = -1.7x + 10.25a$ If perpendicular through B intersects AO at L, $\Rightarrow BL: y = \frac{10}{17}x \qquad \Rightarrow L\left(\frac{3485}{778}, \frac{1025}{389}\right)$
	Correct method to find the required angle	M1	e.g. $\sin\theta = \frac{BL}{BA}$
	Correct unsimplified expression in θ	A1	$= \frac{\sqrt{\left(\frac{3485}{778}\right)^2 + \left(\frac{1025}{389}\right)^2}}{6.5}$
	$\theta = 53$	A1	Q asks for a whole number
		(5)	
			See over for alterrnative

5balt 4	$\bar{x} = 5a$ from B	B1	Or equivalent. Seen or implied Might be seen in (a) but needs to be used here.
	If O is c of m, find coordinates of point of intersection between the line AB and the perpendicular line through O	M1	$AB : y = \frac{12}{5}x$ If perpendicular through O intersects AB at H, $OH : y = -\frac{5}{12}x + \frac{23}{6}, \quad H\left(\frac{230}{169}, \frac{552}{169}\right)$
	Correct method to find the required angle	M1	e.g. $\sin\theta = \frac{OH}{OA}$
	Correct unsimplified expression in θ	A1	$= \frac{\frac{205}{52}}{\sqrt{\frac{389}{16}}}$
	$\theta = 53$	A1	Q asks for a whole number
		[10]	