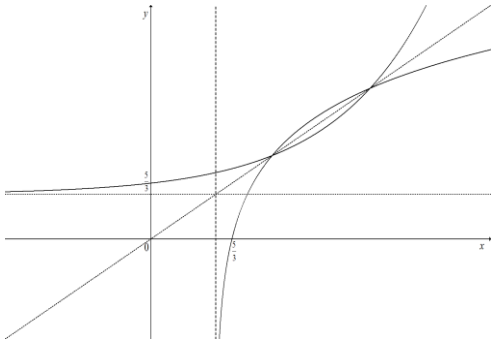
Question	Answer	Marks	Guidance
9(d)		**4**	**B1** for $y = \mathrm{f}(x)$ in the 1st and 4th quadrants and appropriate asymptotic behaviour **B1 dep** on previous B mark for $y = \mathrm{f}^{-1}(x)$ intersecting twice with $y = \mathrm{f}(x)$, in the 1st and 2nd quadrants and appropriate asymptotic behaviour **B1 dep** on first **B1** for $\frac{5}{3}$ marked correctly on each axis or stated, and no other intercepts **B1** for $y = \frac{4}{3}$ and $x = \frac{4}{3}$ (independent) either on the graph or at the side.
10(a)	$\frac{1}{2}\left(\frac{4r}{3}\right)^2\theta - \frac{1}{2}r^2\sin\theta$ oe	**3**	**B1** for $\frac{1}{2}\left(\frac{4r}{3}\right)^2\theta$ **B1** for $\frac{1}{2}r^2\sin\theta$ or $r^2\sin\frac{\theta}{2}\cos\frac{\theta}{2}$ or $\frac{r^2\sin^2\frac{\theta}{2}}{\tan\frac{\theta}{2}}$ oe Allow final answer unsimplified
10(b)	Arc length = $r\frac{(\pi-\theta)}{2}$	**B1**	
	$BE = \sqrt{2r^2(1-\cos\theta)}$ or $2r\sin\frac{\theta}{2}$ or $\frac{r\sin\theta}{\sin\left(\frac{\pi-\theta}{2}\right)}$ oe	**2**	**M1** for complete method to find *BE* or BE^2, using either cosine rule, sine rule or basic trig using *r* and a correct angle. **A0** if an error in rearranging to obtain *BE* is made. Allow unsimplified
	Perimeter = $r(\pi-\theta)+2r+\sqrt{2r^2(1-\cos\theta)}$ oe	**2**	**M1** for a correct plan using *their* lengths 2 arc lengths + 2*r* + *their BE* Allow **A1** for an unsimplified answer

Question	Answer	Marks	Guidance
11(a)	$\overrightarrow{OQ}=\mathbf{a}+\frac{1}{3}(\mathbf{b}-\mathbf{a})$ or $\overrightarrow{OQ}=\mathbf{b}+\frac{2}{3}(\mathbf{a}-\mathbf{b})$ $\left(\overrightarrow{OQ}=\frac{2}{3}\mathbf{a}+\frac{1}{3}\mathbf{b}\right)$	**2**	**M1** for attempt to use $\overrightarrow{OQ}=\mathbf{a}+k(\mathbf{b}-\mathbf{a})$ or $\overrightarrow{OQ}=\mathbf{b}+k(\mathbf{a}-\mathbf{b})$, where k can be positive or negative Allow unsimplified
	$\overrightarrow{PQ}=-\frac{3}{4}\mathbf{a}+their\ \overrightarrow{OQ}$	**M1**	
	$\overrightarrow{PQ}=-\frac{3}{4}\mathbf{a}+\frac{2}{3}\mathbf{a}+\frac{1}{3}\mathbf{b}$ $\left(\overrightarrow{PQ}=\frac{1}{3}\mathbf{b}-\frac{1}{12}\mathbf{a}\right)$	**A1**	Allow unsimplified
	$\overrightarrow{OP}=\frac{3}{4}\mathbf{a}$	**B1**	Allow anywhere
	$\overrightarrow{OR}=\frac{3}{4}\mathbf{a}+\mu\left(\frac{1}{3}\mathbf{b}-\frac{1}{12}\mathbf{a}\right)$ oe	**B1**	Must be simplified
	Alternative		
	$\overrightarrow{PQ}=\frac{1}{4}\mathbf{a}+\frac{1}{3}(\mathbf{b}-\mathbf{a})$ $\left(\overrightarrow{PQ}=\frac{1}{3}\mathbf{b}-\frac{1}{12}\mathbf{a}\right)$	**(4)**	**B1** for $\overrightarrow{PA}=\frac{1}{4}\mathbf{a}$ **M1** for $\overrightarrow{AQ}=\frac{1}{3}(\mathbf{b}-\mathbf{a})$, allow a sign error i.e. use of $(\mathbf{a}-\mathbf{b})$ **M1** for attempt to use $\overrightarrow{PQ}=their\frac{1}{4}\mathbf{a}+their\overrightarrow{AQ}$ Allow unsimplified
	$\overrightarrow{OP}=\frac{3}{4}\mathbf{a}$	**(B1)**	
	$\overrightarrow{OR}=\frac{3}{4}\mathbf{a}+\mu\left(\frac{1}{3}\mathbf{b}-\frac{1}{12}\mathbf{a}\right)$ or $\overrightarrow{OR}=\frac{3}{4}\mathbf{a}-\frac{\mu}{12}\mathbf{a}+\mu\left(\frac{1}{3}\mathbf{b}\right)$ or $\overrightarrow{OR}=\left(\frac{3}{4}-\frac{\mu}{12}\right)\mathbf{a}+\frac{\mu}{3}\mathbf{b}$	**(B1)**	Must be simplified