Question	Answer	Marks	Partial Marks
11	$P = 2\left(\frac{\pi x}{4}\right) + x + 2\left(\frac{400}{x} - \frac{x}{2}\right)$ oe	**B2**	**B1** for rectangle length = $\frac{400}{x}$ soi
	Correct first derivative $\frac{\pi}{2} - \frac{800}{x^2}$	**B1**	**FT** *their P* providing it is of the form $\frac{a}{x} + bx$ oe with *a* an integer and *b* a constant
	Equates *their* $\frac{dP}{dx}$ to 0 and solves for *x*	**M1**	**FT** provided one term of *their* derivative is correct
	$x = \frac{40}{\sqrt{\pi}}$ or 22.6 or 22.56[75...]	**A1**	
	$P = \frac{\pi}{2}\left(\frac{40}{\sqrt{\pi}}\right) + \frac{800}{\frac{40}{\sqrt{\pi}}}$	**M1**	**FT** *their* value of *x* provided it is greater than 0
	P = 70.9 or 70.89[81...]	**A1**	
12(a)	$\overrightarrow{OP} = \frac{4}{7}\mathbf{b} + \lambda\left(\mathbf{c} - \frac{4}{7}\mathbf{b}\right)$ and $\overrightarrow{OP} = \mathbf{b} + \mu\left(\frac{4}{7}\mathbf{c} - \mathbf{b}\right)$	**B3**	**B2** for $\overrightarrow{OP} = \frac{4}{7}\mathbf{b} + \lambda\left(\mathbf{c} - \frac{4}{7}\mathbf{b}\right)$ or $\overrightarrow{OP} = \mathbf{b} + \mu\left(\frac{4}{7}\mathbf{c} - \mathbf{b}\right)$ oe or **B1** for $\overrightarrow{OP} = \left(their\,\frac{4}{7}\right)\mathbf{b} + \lambda\left(\mathbf{c} - \left(their\,\frac{4}{7}\right)\mathbf{b}\right)$ or $\overrightarrow{OP} = \mathbf{b} + \mu\left(\left(their\,\frac{4}{7}\right)\mathbf{c} - \mathbf{b}\right)$ or
	Equates components e.g.: $\left(their\,\frac{4}{7}\right)(1-\lambda) = (1-\mu)$ or $\lambda = their\,\frac{4}{7}\mu$	**M1**	**FT** providing at least **B1** awarded and two expressions for $\overrightarrow{OP}$ in terms of **b, c**, λ and μ found
	$\frac{4}{7}(1-\lambda) = (1-\mu) \quad \lambda = \frac{4}{7}\mu$ oe	**A1**	
	$\lambda = \frac{4}{11}$ and $\mu = \frac{7}{11}$ oe and conclusion $AP : AC$ = 4 : 11 therefore $AP : PC$ = 4 : 7 $BP : BD$ = 7 : 11 therefore $DP : PB$ = 4 : 7 oe	**A2**	**A1** for $\lambda = \frac{4}{11}$ or $\mu = \frac{7}{11}$ oe

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Question	Answer	Marks	Partial Marks
12(b)	$\overrightarrow{OP} = \frac{4}{11}(\mathbf{b}+\mathbf{c})$ or $\overrightarrow{OP} = \frac{4}{11}\mathbf{b} + \frac{4}{11}\mathbf{c}$ and $\overrightarrow{OP}$ and $\overrightarrow{OQ}$ are scalar multiples of each other and have a point in common oe	**2**	**M1** for $\overrightarrow{OP} = \frac{4}{11}(\mathbf{b}+\mathbf{c})$ or $\overrightarrow{OP} = \frac{4}{11}\mathbf{b} + \frac{4}{11}\mathbf{c}$

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