

Q	Marking instructions	AO	Marks	Typical solution
13(a)(i)	Forms an equation for the area of the form $Axw + B\pi x^2 = 100$,	3.3	M1	$4wx + \frac{1}{2}\pi x^2 = 100$ $4wx = 100 - \frac{1}{2}\pi x^2$ $4wx = \frac{200 - \pi x^2}{2}$ $w = \frac{200 - \pi x^2}{8x}$
	Completes reasoned argument with at least one more line of working to show $\text{width} = \frac{200 - \pi x^2}{8x}$	2.1	R1	
	Subtotal		2	

Q	Marking instructions	AO	Marks	Typical solution
13(a)(ii)	Obtains $6x + 2w + \pi x$ Can be unsimplified ISW Accept a consistently used alternative letter for width.	3.3	B1	$P = 6x + 2w + \pi x$ $P = 6x + 2\left(\frac{200 - \pi x^2}{8x}\right) + \pi x$ $= 6x + \frac{50}{x} - \frac{\pi x}{4} + \pi x$ $= \left(6 + \frac{3\pi}{4}\right)x + \frac{50}{x}$
	Uses the given result from part (a)(i) to eliminate w from their expression for perimeter in the form $Ax + Bw + C\pi x$ to form an expression for P in terms of x	3.4	M1	
	Completes reasoned argument with at least one more line of working, with no errors seen, to show $P = \left(6 + \frac{3\pi}{4}\right)x + \frac{50}{x}$	2.1	R1	
	Subtotal		3	

Q	Marking instructions	AO	Marks	Typical solution
13(b)(i)	Explains a minimum or stationary point will occur when $\frac{dP}{dx} = 0$ or $\frac{dC}{dx} = 0$ where C is the cost.	2.4	E1	The minimum perimeter will occur when $\frac{dP}{dx} = 0$
	Uses the model to minimise perimeter or cost. For example Differentiates P w.r.t. x with either $6 + \frac{3\pi}{4}$ or $-\frac{50}{x^2}$ correct. Could be multiplied by 12.75	3.4	M1	$\frac{dP}{dx} = 6 + \frac{3\pi}{4} - \frac{50}{x^2}$ $6 + \frac{3\pi}{4} - \frac{50}{x^2} = 0$ $x^2 = \frac{200}{24 + 3\pi}$ $x = 2.45$ Cost = $\left(\left(6 + \frac{3\pi}{4} \right) \times 2.45 + \frac{50}{2.45} \right) \times 12.75$
	Obtains $6 + \frac{3\pi}{4} - \frac{50}{x^2}$ Could be multiplied by 12.75	1.1b	A1	$= 521.23$ $£521.23$
	Uses their $6 + \frac{3\pi}{4} - \frac{50}{x^2} = 0$ to obtain a positive value for x	1.1a	M1	$\frac{d^2P}{dx^2} = \frac{100}{x^3} = \frac{100}{2.45^3} = 6.8 > 0$ $\therefore P \text{ is a min}$
	Obtains cost of £521.23 or £521.24	3.2a	A1	So the minimum cost is £521.23
	Justifies that the cost/perimeter is a minimum. For example Shows that $\frac{d^2P}{dx^2} = \frac{100}{x^3} > 0$, since $x > 0$ Or Compares sign of gradient either side of $x = \text{AWRT } 2.45$	2.4	E1	
	Subtotal		6	

Q	Marking instructions	AO	Marks	Typical solution
13(b)(ii)	Gives a reason connected with the length why the cost is likely to be more: - Unlikely to be able to purchase exactly the right length of material. - There might be wastage if the material has to be cut - Corners/curves may cause increased length, possibly due to thickness of material.	3.5a	E1	It is unlikely the material can be bought in exactly the required length.
	Subtotal		1	
	Question 13 Total		12	