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	$4wx + \frac{1}{2}\pi x^2 = 100$
	Completes reasoned argument with at least one more line of working to show $width = \frac{200 - \pi x^2}{8x}$	2.1	R1	$4wx = 100 - \frac{1}{2}\pi x^2$ $4wx = \frac{200 - \pi x^2}{2}$ $w = \frac{200 - \pi x^2}{8x}$
	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	$P = 6x + 2w + \pi x$
	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	$P = 6x + 2\left(\frac{200 - \pi x^2}{8x}\right) + \pi x$ $= 6x + \frac{50}{x} - \frac{\pi x}{4} + \pi x$
	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	$= \left(6 + \frac{3\pi}{4}\right)x + \frac{50}{x}$
	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 $\frac{dP}{dx}=0$ $\frac{dP}{dx}=6+\frac{3\pi}{4}-\frac{50}{x^2}$ $6+\frac{3\pi}{4}-\frac{50}{x^2}=0$ $x^2=\frac{200}{24+3\pi}$ $x=2.45$ Cost = $\left(\left(6+\frac{3\pi}{4}\right)\times 2.45+\frac{50}{2.45}\right)\times 12.75$ $=521.23$ £521.23 $\frac{d^2P}{dx^2}=\frac{100}{x^3}=\frac{100}{2.45^3}=6.8>0$ $\therefore P$ is a min So the minimum cost is £521.23
	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	
	Obtains $6+\frac{3\pi}{4}-\frac{50}{x^2}$ Could be multiplied by 12.75	1.1b	A1	
	Uses their $6+\frac{3\pi}{4}-\frac{50}{x^2}=0$ to obtain a positive value for x	1.1a	M1	
	Obtains cost of £521.23 or £521.24	3.2a	A1	
	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 = 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**	