Q	Marking instructions	AO	Marks	Typical solution
5(a)(i)	Uses formula correctly for area of sector	1.1a	M1	$A=\frac{1}{2}\times 5^2\times 0.7$ $=8.75\,\text{m}^2$
	Obtains 8.75 Condone incorrect or missing units	1.1b	A1	
	Subtotal		**2**	

Q	Marking instructions	AO	Marks	Typical solution
5(a)(ii)	Uses formula for arc length	1.1b	B1	$P=5\times 0.7+2\times 5$ $=13.5$ $Cost=13.5\times 1.80$ $=£24.30$
	Obtains the perimeter by adding twice the radius to their arc length and multiplies their perimeter by 1.80	3.1b	M1	
	Obtains correct cost £24.30 **CAO**	3.2a	A1	
	Subtotal		**3**	

Q	Marking instructions	AO	Marks	Typical solution
5(b)(i)	Forms at least one correct equation for area or perimeter May be embedded in the formulae for C	3.3	M1	$P=r\theta+2r$ $\frac{1}{2}r^2\theta=20$ $\Rightarrow\theta=\frac{40}{r^2}$ $P=\frac{40}{r}+2r$ $C=\frac{40\times 1.8}{r}+2\times 1.8r$ $=\frac{72}{r}+\frac{18}{5}r$ $=\frac{18}{5}\left(\frac{20}{r}+r\right)$
	Eliminates θ from two fully correct equations for area and perimeter to obtain an expression for P in terms of r	3.1b	A1	
	Completes argument to show the required result Accept 3.6 for $\frac{18}{5}$	2.1	R1	
	Subtotal		**3**	

Q	Marking instructions	AO	Marks	Typical solution
5(b)(ii)	Recognises the use differentiation in the model **PI** if $\frac{dC}{dr}$ seen	3.4	B1	$C = \frac{72}{r} + \frac{18}{5}r$ $\frac{dC}{dr} = -\frac{72}{r^2} + \frac{18}{5}$ Minimum occurs when $\frac{dC}{dr} = 0$ $-\frac{72}{r^2} + \frac{18}{5} = 0$ $r^2 = 20$ $r = \sqrt{20} \approx 4.472..$ Hence $r \approx 4.5$ $\frac{d^2C}{dr^2} = \frac{144}{r^3}$ When $r = \sqrt{20}$, $\frac{d^2C}{dr^2} > 0$ Therefore minimum at $r \approx 4.5$
	Differentiates given model with at least one term correct Condone sign error **OE**	1.1b	M1	
	Explains that a minimum/stationary/turning point occurs when $\frac{dC}{dr} = 0$	2.4	E1	
	Solves $\frac{dC}{dr} = 0$ to find correct exact value or decimal value for r to at least two decimal places	1.1b	A1	
	Uses a gradient test or second derivative or sketches graph to determine nature of stationary point Completes argument to show minimum occurs when $r \approx 4.5$ Must have shown $r \approx 4.5$ in previous step	2.1	R1	
	Subtotal		**5**	

	Question Total		**13**	