Question number	Scheme	Marks
8 a	Height of the waste paper basket = $\sqrt{(5x)^2-(3x)^2}=4x$ (cm)	M1
	$V=\frac{1}{2}(2x+8x)\times 4x\times h=20x^2h=2250\Rightarrow h=\frac{2250}{20x^2}$ oe	M1
	$S=2\times 20x^2+2xh+2(5xh)$	M1
	$S=40x^2+12x\left(\frac{2250}{20x^2}\right)$ oe	M1
	$S=40x^2+\frac{1350}{x}$ *	A1 cso (5)
b	$\frac{\mathrm{d}S}{\mathrm{d}x}=80x-\frac{1350}{x^2}$ oe	M1
	$\frac{\mathrm{d}S}{\mathrm{d}x}=80x-\frac{1350}{x^2}=0$ so $x^3=\frac{135}{8}\Rightarrow x=\ldots$	M1
	$x=2.56$ awrt	A1
	$\frac{\mathrm{d}^2S}{\mathrm{d}x^2}=80+\frac{2700}{x^3}>0$ for all positive values of $x\therefore$ minimum	M1 A1ft (5)
c	When $x=2.56$ $S=40(2.56)^2+\frac{1350}{2.56}=789$ awrt	M1 A1 (2)
		Total 12 marks

Part	Mark	Notes
(a)	**M1**	For finding the height of the waste-paper basket using Pythagoras theorem. $\sqrt{(5x)^2-(3x)^2}=4x$ (cm)
	M1	For finding the volume which must come from; V = correct area of trapezium (using their height) × h $V=\frac{1}{2}(2x+8x)\times '4x'\times h=2250 \Rightarrow ('20'x^2h=2250)$ **and** for obtaining an expression for the height h: $h=\frac{2250}{'20'x^2}$ or $xh=\frac{2250}{'20'x}$ Please check their algebra carefully, as some may even substitute $hx^2=...$ **NB: This is an A mark in Epen.**
	M1	For writing the surface area in terms of 2 unknowns [x and h] which need not be simplified. This must be **correct** using their expression in terms of x for the height of the prism. e.g. $S=2\times\frac{(8x+2x)\times '4x'}{2}+2xh+2(5xh)=[40x^2+12xh]$
	M1	For eliminating h from their expression for S S must be in the form Ax^2+Bxh and h must be of the form $\frac{C}{x^2}$ where A, B and C are constants.
	A1 cso	For the given result exactly as written. $S=40x^2+\frac{1350}{x}$
(b)	**M1**	For an acceptable attempt to differentiate the **given** expression for S. See General Guidance.
	M1	For setting their $\frac{dS}{dx}=0$ and attempting to find a value for x The minimum acceptable expression is $\frac{dS}{dx}=Px\pm\frac{Q}{x^2}$ where P and Q are constants.
	A1	For awrt $x=2.56$
	M1	For differentiating their $\frac{dS}{dx}$, which must be as a minimum $\frac{dS}{dx}=Px\pm\frac{Q}{x^2}$ to find the second derivative to achieve as a minimum $\frac{d^2S}{dx^2}=\pm M\pm\frac{N}{x^3}$
	A1ft	Concludes that as $\frac{d^2S}{dx^2}$ will always be positive, [either by substitution, or by inference] so the value of x obtained will be a minimum. $\left[\frac{d^2S}{dx^2}=80+\frac{2700}{2.56^3}=240.9...\right]$ with a conclusion. **NOTE:** The ft only applies to their value of x. Do not ft an incorrect $\frac{d^2S}{dx^2}$
(c)	**M1**	Substitutes their value of x, obtained using a correct method) into the **given** expression for S [provided it is a positive value, do **NOT** allow negative values of x]
	A1	For awrt 789