Question	Answer	Marks	Partial Marks
11	Length of rectangle: $6 + e^3$ or $\left[(6+e^3)x\right]_0^2$	**M1**	
	Area of rectangle: $2(6 + e^3)$ soi	**A1**	
	Area between curve and x-axis: $\int_0^2 (6+e^{4x-5})\,dx = \left[6x+\frac{1}{4}e^{4x-5}\right]_0^2$	**M2**	**M1** for $\frac{1}{4}e^{4x-5}$
	Correct use of limits in *their* $6x+\frac{1}{4}e^{4x-5}$: F(2) – F(0)	**M1**	dep on an attempt to integrate that results in $ax + be^{4x-5}$
	their area of rectangle – *their* area between curve and x-axis	**M1**	dep on an attempt to integrate using correct limits
	$\frac{7}{4}e^3+\frac{1}{4e^5}$ or 35.2 or 35.15.... isw	**A1**	nfww
11	**Alternative method**		
	Length of rectangle: $6 + e^3$ soi	**(M1)**	
	$\int_0^2 \left(their(6+e^3)-(6+e^{4x-5})\right)dx$	**(M1)**	
	$\int_0^2 \left((6+e^3)-(6+e^{4x-5})\right)dx$ oe	**(A1)**	
	$\int_0^2 (e^3-e^{4x-5})\,dx = \left[e^3x-\frac{1}{4}e^{4x-5}\right]_0^2$ oe	**(M2)**	**M1** for $\frac{1}{4}e^{4x-5}$
	Correct use of limits in *their* $e^3x-\frac{1}{4}e^{4x-5}$ F(2) – F(0)	**(M1)**	dep on an attempt to integrate that results in $ax + be^{4x-5}$; may be unsimplified
	$\frac{7}{4}e^3+\frac{1}{4e^5}$ or 35.2 or 35.151374.... rot to 4 or more sf	**(A1)**	nfww

Question	Answer	Marks	Partial Marks
12(a)	$\frac{PQ}{8}=\frac{12-h}{12}$ oe or $\left(\frac{12-h}{12}\right)^2=\frac{\text{Area }\Delta PQR}{16\sqrt{3}}$ oe	**M1**	
	$PQ=\frac{8(12-h)}{12}$ oe or Area $\Delta PQR=16\sqrt{3}\left(\frac{12-h}{12}\right)^2$ oe	**A1**	
	$V=\frac{1}{2}\times\left(\frac{8(12-h)}{12}\right)^2\times\sin\frac{\pi}{3}\times h$ oe or $16\sqrt{3}\left(\frac{12-h}{12}\right)^2\times h$	**M1**	**FT** *their PQ* or Area ΔPQR providing of correct structure
	$V=\frac{\sqrt{3}}{9}(h^3-24h^2+144h)$	**A1**	
12(b)	$\frac{\mathrm{d}V}{\mathrm{d}h}=\frac{\sqrt{3}}{9}(3h^2-48h+144)$	**B1**	**FT** *their* $V=\frac{\sqrt{3}}{9}(h^3-24h^2+144h)$ if of the same structure
	their $\frac{\sqrt{3}}{9}(3h^2-48h+144)=0$ and factorises/solves	**M1**	must be a 3-term quadratic; must be an attempt at a derivative
	4 oe identified as the only solution; cao	**A1**	