Question Number	Scheme	Notes	Marks
8(a)	$\left\{\frac{\mathrm{d}y}{\mathrm{d}x}=\right\}\operatorname{arcosh}5x+\frac{ax}{\sqrt{bx^2-1}}$ or $\operatorname{arcosh}5x+\frac{cx}{\sqrt{x^2-d}}$ (M1) $\Rightarrow \operatorname{arcosh}(5x)+\frac{5x}{\sqrt{25x^2-1}}$ (A1) M1: Differentiates to obtain expression of the correct form $a, b, c, d \neq 0$ A1: Correct differentiation. Any equivalent form.		M1 A1
			(2)
(b)	$\frac{\mathrm{d}}{\mathrm{d}x}\left(x\operatorname{arcosh}(5x)\right)=\operatorname{arcosh}(5x)+"\frac{5x}{\sqrt{25x^2-1}}" \Rightarrow \int \operatorname{arcosh}(5x)\,\mathrm{d}x = x\operatorname{arcosh}(5x)-\int "\frac{5x}{\sqrt{25x^2-1}}"\mathrm{d}x$ M1: Rearranges **their** answer to (a) correctly and integrates or uses the correct formula to apply parts to $1\times\operatorname{arcosh}5x$ to obtain the above.		M1
	$\int \operatorname{arcosh}(5x)\,\mathrm{d}x = x\operatorname{arcosh}(5x)-\int\frac{5x}{\sqrt{25x^2-1}}\,\mathrm{d}x$ A1: **Correct** expression – but **see note below on limited ft**		A1 **(limited ft)**
	$=x\operatorname{arcosh}(5x)-\frac{1}{5}\left(25x^2-1\right)^{\frac{1}{2}}\ (+c)$	M1: $\int\frac{Ax}{\sqrt{Bx^2-1}}\,\mathrm{d}x\rightarrow C\left(Bx^2-1\right)^{\frac{1}{2}}$ A1: Fully correct expression with $x$arcosh(5x) - see note below for limited ft	M1 A1 **(limited ft)**
	Note: Substitutions : $u=5x\Rightarrow\left(u^2-1\right)^{\frac{1}{2}}\Rightarrow\left[\frac{1}{5}\sqrt{u^2-1}\right]_{\frac{5}{4}}^{3}$ $u=25x^2-1\Rightarrow\left[\frac{1}{5}\sqrt{u}\right]_{\frac{9}{16}}^{8}$ M1: Correct form A1: Fully correct expression with $x$arcosh(5x)		
	A limited ft for **one** of the errors in (a) shown below applies for the first two A marks. **However also allow the following if this error occurs in part (b)** which is most likely to come from not rearranging and effectively restarting by using parts. Note that substitutions could be used. $a=1\Rightarrow x\operatorname{arcosh}(5x)-\int\frac{x}{\sqrt{25x^2-1}}\,\mathrm{d}x\Rightarrow x\operatorname{arcosh}(5x)-\frac{1}{25}\left(25x^2-1\right)^{\frac{1}{2}}\ (+c)$ $b=5\Rightarrow x\operatorname{arcosh}(5x)-\int\frac{5x}{\sqrt{5x^2-1}}\,\mathrm{d}x\Rightarrow x\operatorname{arcosh}(5x)-\left(5x^2-1\right)^{\frac{1}{2}}\ (+c)$ $a=-5\Rightarrow x\operatorname{arcosh}(5x)+\int\frac{5x}{\sqrt{25x^2-1}}\,\mathrm{d}x\Rightarrow x\operatorname{arcosh}(5x)+\frac{1}{5}\left(25x^2-1\right)^{\frac{1}{2}}\ (+c)$		
	$\int_{\frac{1}{4}}^{\frac{3}{5}}\operatorname{arcosh}5x\,\mathrm{d}x=\frac{3}{5}\operatorname{arcosh}(3)-\frac{1}{5}\sqrt{25\times\frac{9}{25}-1}-\left(\frac{1}{4}\operatorname{arcosh}\left(\frac{5}{4}\right)-\frac{1}{5}\sqrt{25\times\frac{1}{16}-1}\right)$ Applies appropriate limits (note substitutions above) with subtraction the right way round seen to obtain an expression of the form $x\operatorname{arcosh}(5x)\pm\mathrm{f}(x)$ **where f(x) has come from integration**		M1
	$=\frac{3}{5}\operatorname{arcosh}(3)-\frac{2\sqrt{2}}{5}-\frac{1}{4}\operatorname{arcosh}\left(\frac{5}{4}\right)+\frac{3}{20}$	Correct answer seen in any form. **Must not follow clearly incorrect work.**	A1
	$\operatorname{arcosh}3=\ln\left(3+\sqrt{3^2-1^2}\right)$ or $\operatorname{arcosh}\left(\frac{5}{4}\right)=\ln\left(\frac{5}{4}+\sqrt{\left(\frac{5}{4}\right)^2-1^2}\right)$ $\left\{\Rightarrow\frac{3}{5}\ln\left(3+\sqrt{8}\right)-\frac{2\sqrt{2}}{5}-\frac{1}{4}\ln 2+\frac{3}{20}\right\}$	Converts $\operatorname{arcosh}(3)$ or $\operatorname{arcosh}\left(\frac{5}{4}\right)$ to any correct log form. Independent mark but must have obtained $x\operatorname{arcosh}(5x)\pm\mathrm{f}(x)$ **where f(x) has come from integration**	M1
	$=\frac{3}{20}-\frac{2\sqrt{2}}{5}+\ln\left(3+2\sqrt{2}\right)^{\frac{3}{5}}-\frac{1}{4}\ln 2$ **Must not follow clearly incorrect work.**	Correct answer. Terms in any order but otherwise written as shown. Allow values for p, q, r & k	A1
			(8)
			Total 10

	PAPER TOTAL: 75

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