Question Number	Scheme	Notes	Marks
6(a)	$16x^2-48x+40$ $=16\left(x^2-3x+\frac{5}{2}\right)$ $=16\left(\left(x-\frac{3}{2}\right)^2+\frac{1}{4}\right)$ $=16\left(x-\frac{3}{2}\right)^2+4$	B1: Two of $a=16$, $b=-\frac{3}{2}$ and $c=4$ either listed or embedded within their expression B1: Fully correct expression or correct values given as their final answer **Note:** neither $4\left(\left(2x-3\right)^2+1\right)$ nor $1\left(\left(4x-6\right)^2+4\right)$ are in the required form and score B0 B0, but marks in parts (b) and (c) may be available.	B1 B1
			(2)
(b)	**Notes:** • **In this part, if there is no hyperbolic substitution, the response should be scored B0 M0 dM0 A0.** • If the candidate has a negative c value from part (a), the integration in (b) may require a different hyperbolic substitution, e.g. using cosh rather than sinh. Please send any such responses to review.		
	$2x-3=\sinh u \Rightarrow x=\frac{1}{2}\sinh u+\frac{3}{2} \Rightarrow \frac{\mathrm{d}x}{\mathrm{d}u}=\frac{1}{2}\cosh u$	Correct differentiation of $x=d\sinh u+e,\quad d,\ e\neq 0$ $\Rightarrow \frac{\mathrm{d}x}{\mathrm{d}u}=d\cosh u$	B1
	$\int \frac{\mathrm{d}x}{\sqrt{16x^2-48x+40}}=\frac{1}{4}\int \frac{\left(\mathrm{d}x\right)^2}{\sqrt{\left(x-\frac{3}{2}\right)^2+\frac{1}{4}}}=\frac{1}{4}\int \frac{\frac{1}{2}\cosh u\,\mathrm{d}u}{\sqrt{\left(\frac{1}{2}\sinh u\right)^2+\frac{1}{4}}}$ Complete attempt at substitution using $x=d\sinh u+e\ \ d,e\neq 0$ and $\frac{\mathrm{d}x}{\mathrm{d}u}=d\cosh u$		M1
	$=\frac{1}{4}\int \frac{\sinh^2 u+1}{\sqrt{\cosh u}}\mathrm{d}u=\frac{1}{4}\int \cosh u\,\mathrm{d}u$	Reaches $k\int \mathrm{d}u$ following a substitution of the required form. Do not be too concerned about errors in the processing to reach this point.	dM1
	$=\frac{1}{4}u\ (+c)=\frac{1}{4}\operatorname{arsinh}(2x-3)\ \{+c\}$ or $\frac{1}{4}\ln\left(2x-3+\sqrt{(2x-3)^2+1}\right)\{+c\}$ or $\frac{1}{4}\ln\left(x-\frac{3}{2}+\sqrt{\left(x-\frac{3}{2}\right)^2+\frac{1}{4}}\right)\{+c\}$	Correct answer in terms of arsinh or using a correct logarithmic form.	A1
			(4)

(c)	$\int_{\frac{15}{48}}^{\frac{5}{24}} \frac{\mathrm{d}x}{\sqrt{16x^2-48x+40}} = \frac{1}{4}\left(\operatorname{arsinh}\frac{3}{4} - \operatorname{arsinh}\frac{5}{12}\right)$	Substitutes given limits into an arsinh function (or a valid logarithmic form) and subtracts either way round. If their final answer to (b) is in terms of u, accept an attempt to calculate and substitute the corresponding u values.	M1
	$= \frac{1}{4}\left(\ln\left(\frac{3}{4}+\sqrt{\left(\frac{3}{4}\right)^2+1}\right) - \ln\left(\frac{5}{12}+\sqrt{\left(\frac{5}{12}\right)^2+1}\right)\right)$	One correct use of a logarithmic form of arsinh. Not dependent on first M1.	M1
	$= \frac{1}{4}\left(\ln 2 - \ln\frac{3}{2}\right) = \frac{1}{4}\ln\frac{4}{3}$ or $-\frac{1}{4}\ln\left(\frac{3}{4}\right)$	Correct answer in required form	A1
			(3)
			Total 9