Question	Scheme	Marks
5(a)	$1=2\sin u \Rightarrow p=\sin^{-1}\left(\frac{1}{2}\right)=\frac{\pi}{6}$	B1
	$x=2\sin u \Rightarrow \frac{\mathrm{d}x}{\mathrm{d}u}=2\cos u$ oe	M1
	$\int \frac{3x+2}{\left(4-x^2\right)^{\frac{3}{2}}}\,\mathrm{d}x=\int \frac{6\sin u+2}{\left(4-4\sin^2 u\right)^{\frac{3}{2}}}\,2\cos u\,\mathrm{d}u=\int \frac{6\sin u+2}{\left(4\cos^2 u\right)^{\frac{3}{2}}}\,2\cos u\,\mathrm{d}u$	M1
	$=\int \frac{12\sin u}{8\cos^2 u}+\frac{2}{4\cos^2 u}\,\mathrm{d}u=\int_0^{\frac{\pi}{6}}\left(\frac{3}{2}\sec u\tan u+\frac{1}{2}\sec^2 u\right)\mathrm{d}u$ *	A1*
		(4)
(b)	$\int \left(\frac{3}{2}\sec u\tan u+\frac{1}{2}\sec^2 u\right)\mathrm{d}u=\frac{3}{2}\sec u+\frac{1}{2}\tan u$	M1A1
	$\left[\frac{3}{2}\sec u+\frac{1}{2}\tan u\right]_0^{"\frac{\pi}{6}"}=\left(\frac{3}{2}\sec\left("\frac{\pi}{6}"\right)+\frac{1}{2}\tan\left("\frac{\pi}{6}"\right)\right)-\left(\frac{3}{2}\sec 0+\frac{1}{2}\tan 0\right)=...$	M1
	$=\sqrt{3}+\frac{\sqrt{3}}{6}-\frac{3}{2}=\frac{7\sqrt{3}}{6}-\frac{3}{2}\ \left(=\frac{7\sqrt{3}-9}{6}\right)$	A1
		(4)
		(8 marks)

Notes

(a)

B1: $p=\frac{\pi}{6}$ Allow if seen anywhere, even in (b). p = 30 is B0.

M1: $x=2\sin u \Rightarrow \frac{\mathrm{d}x}{\mathrm{d}u}=\pm...\cos u$ or any rearrangement of this equation.

M1: **Full** substitution from an integral in terms of x to an integral in terms of u and **uses** the identity $\sin^2 u+\cos^2 u=1$ in the denominator. Do not be concerned with the limits for this mark.

A1*: Achieves given answer include du (with their p) with no errors and at least one intermediate step with the fractional power simplified. Condone missing du in intermediate lines.

(b)

M1: $\int \left(\frac{3}{2}\sec u\tan u+\frac{1}{2}\sec^2 u\right)\mathrm{d}u=...\sec u+...\tan u$

A1: $\frac{3}{2}\sec u+\frac{1}{2}\tan u$ ignore any constant c

M1: Depends on having one term of the correct form, attempts to substitute in their p ($\neq 1$) and 0, subtracting either way round. The substitution must be seen or clearly implied, e.g. by correct values for each term in an intermediate step before the answer (allowing missing 0's).

A1: $\frac{7\sqrt{3}}{6}-\frac{3}{2}$ or exact equivalent eg $\frac{7\sqrt{3}-9}{6}$ Allow if p = 30° was used.

Question	Scheme	Marks
6(a)	$\overrightarrow{AB} = \begin{pmatrix} 5-1 \\ 3--4 \\ -2-3 \end{pmatrix} = \begin{pmatrix} 4 \\ 7 \\ -5 \end{pmatrix} = 4\mathbf{i}+7\mathbf{j}-5\mathbf{k}$	M1
	e.g. $\mathbf{r} = \mathbf{i}-4\mathbf{j}+3\mathbf{k}+\lambda(4\mathbf{i}+7\mathbf{j}-5\mathbf{k})$ or $\mathbf{r} = 5\mathbf{i}+3\mathbf{j}-2\mathbf{k}+\lambda(4\mathbf{i}+7\mathbf{j}-5\mathbf{k})$	M1A1
		(3)
(b)	$\overrightarrow{AC} = \begin{pmatrix} 3-1 \\ p--4 \\ -1-3 \end{pmatrix} = \begin{pmatrix} 2 \\ p+4 \\ -4 \end{pmatrix} = 2\mathbf{i}+(p+4)\mathbf{j}-4\mathbf{k}$	M1
	$\begin{pmatrix} 2 \\ p+4 \\ -4 \end{pmatrix} \bullet \begin{pmatrix} 4 \\ 7 \\ -5 \end{pmatrix} = 8+7p+28+20=0 \Rightarrow p=-8$	M1A1
		(3)
(c)	$\lvert AB \rvert = \sqrt{4^2+7^2+(-5)^2} = \sqrt{90}$ or $\lvert AC \rvert = \sqrt{2^2+(-4)^2+(-4)^2} = 6$	M1
	Area $\frac{1}{2}\times"\sqrt{90}"\times"6" = 9\sqrt{10}$	dM1A1
		(3)
		(9 marks)

Notes

Accept either vector form throughout but extra i, j k in column vectors will lose A mark in (a).

(a) This is now being marked MMA

M1: Attempts to find $\overrightarrow{AB}$. Score for subtracting either way round. Implied by 2 out of 3 correct coordinates.

M1: Attempts equation for the line, score for $\overrightarrow{OA}+\lambda\times\text{their}\,\overrightarrow{AB}$ or $\overrightarrow{OB}+\lambda\times\text{their}\,\overrightarrow{AB}$ No need for **r** = for this mark.

A1: Any correct equation. Must be **r** = … (l = .. is A0)

(b)

M1: Attempts to find $\overrightarrow{AC}$. Score for subtracting either way round. Implied by 2 out of 3 correct coordinates.

M1: Takes scalar product of their $\overrightarrow{AB}$ and their $\overrightarrow{AC}$ to form and solve a linear equation in p

A1: $p=-8$

(c)

M1: Attempts to find the magnitude of either their $\overrightarrow{AB}$ or their $\overrightarrow{AC}$ using their p

dM1: Attempts to find the exact area of the triangle ABC. It is dependent on the previous method mark. There most common method will be $\frac{1}{2}\left|\overrightarrow{AB}\right|\left|\overrightarrow{AC}\right|$ as in scheme but other methods are possible. E.g.

$\cos\angle ABC = \dfrac{\overrightarrow{BA}.\overrightarrow{BC}}{\left|\overrightarrow{BA}\right|\left|\overrightarrow{BC}\right|} \Rightarrow A = \frac{1}{2}\left|\overrightarrow{BA}\right|\left|\overrightarrow{BC}\right|\sin\angle ABC$. Such a method must be complete, including use of Pythagorean identity to find $\sin\angle ABC$. Other more advanced methods (such as cross products) are also possible. If you see something you feel is worthy of some credit but does not fit the scheme, send to Review.

A1: $9\sqrt{10}$