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: $9\sqrt{10}$

Question	Scheme	Marks
7(a)	$\frac{dx}{dt} = \cos t + 6\cos t \sin t \qquad \frac{dy}{dt} = 3\cos t - 2\sin t$	B1B1
	$\frac{dy}{dx} = \frac{dy}{dt} \times \frac{dt}{dx} = \frac{3\cos t - 2\sin t}{\cos t + 6\cos t \sin t} = \frac{3\cos\pi - 2\sin\pi}{\cos\pi + 6\cos\pi\sin\pi} = 3$ *	M1A1*
		(4)
(b)	When $t = \pi$, $x = -3$, $y = -2$	B1
	$y - "-2" = 3(x - "-3")$	M1
	$y = 3x + 7$	A1
		(3)
(c)	$y = 3x + 7 \Rightarrow 3\sin t + 2\cos t = 3\left(\sin t - 3\cos^2 t\right) + 7$ or $y = 3\left(x + 3\cos^2 t\right) + 2\cos t \Rightarrow 3x + 7 = 3x + 9\cos^2 t + 2\cos t$	M1
	$\Rightarrow 9\cos^2 t + 2\cos t - 7 = 0$ *	A1*
		(2)
(d)	$\cos t = \frac{7}{9}$	B1
	$y = 3 \times \frac{\sqrt{32}}{9} + 2 \times \frac{7}{9} = \frac{4\sqrt{2}}{3} + \frac{14}{9}$	M1A1
		(3)
		(12 marks)

Notes

(a)

B1: $\left(\frac{dx}{dt} =\right) \cos t + 6\cos t \sin t$ or $\cos t + 3\sin 2t$

B1: $\left(\frac{dy}{dt} =\right) 3\cos t - 2\sin t$

M1: Attempts $\frac{dy}{dx} = \frac{dy}{dt} \times \frac{dt}{dx}$ using their $\frac{dx}{dt}$ and their $\frac{dy}{dt}$ and substitutes $t = \pi$. (May substitute π before dividing.)

A1*: Achieves $\frac{dy}{dx} = 3$ with full working shown and no errors.

(b)

B1: $x = -3$, $y = -2$ which may be seen within their working

M1: Attempts to find the equation of the tangent with gradient 3. If they use $y = mx + c$ they must proceed as far as $c = ...$

A1: $y = 3x + 7$

(c)

M1: A full attempt to solve simultaneously the given parametric equations with their equation of the tangent

A1*: Achieves $9\cos^2 t + 2\cos t - 7 = 0$ with no errors

(d)

B1: $\cos t = \frac{7}{9}$ seen or implied. Allow if seen in (c).

M1: Attempts to find the *y* coordinate Must attempt to evaluate trig terms. If no substitution/working shown, then score for awrt 3.44 following a correct value for cos *t*

A1: $\frac{4\sqrt{2}}{3} + \frac{14}{9}$ or exact equivalent. Withhold if additional answers are given.