Question number	Scheme	Marks
4 (a)	Gradient = $\dfrac{11+10}{3+4}=3$ $y+10=3(x+4)$ or $y-11=3(x-3)$ oe	M1A1 (2)
(b)	e.g. $\left(\dfrac{4\times -4+3\times 3}{3+4},\dfrac{4\times -10+3\times 11}{3+4}\right)=(-1,-1)$	M1 A1 (2)
ALT (b)	Using Vectors $\begin{pmatrix}-4\\-10\end{pmatrix}+\dfrac{3}{7}\begin{pmatrix}7\\21\end{pmatrix}=\begin{pmatrix}-1\\-1\end{pmatrix}$ or $\begin{pmatrix}3\\11\end{pmatrix}-\dfrac{4}{7}\begin{pmatrix}7\\21\end{pmatrix}=\begin{pmatrix}-1\\-1\end{pmatrix}$	{M1} {A1}
(c)	$-\dfrac{1}{3}=\dfrac{n+1}{m+1}\Rightarrow -\dfrac{1}{3}(m+1)=n+1$ $\left(\sqrt{10}\right)^2=(m+1)^2+(n+1)^2$ $10=(m+1)^2+\dfrac{1}{9}(m+1)^2$ $9=(m+1)^2$ $m=-4 \quad n=0$	M1 M1 M1 M1 A1 A1 (6)
ALT (c)	Using Vectors $\overrightarrow{AB}=\begin{pmatrix}7\\21\end{pmatrix}$ so perpendicular to $\overrightarrow{AB}=\begin{pmatrix}21\\-7\end{pmatrix}$ $\left\lvert\overrightarrow{AB}\right\rvert=7\sqrt{10}\Rightarrow,\left\lvert\overrightarrow{AP}\right\rvert=3\sqrt{10}$ $\overrightarrow{PQ}=\dfrac{\sqrt{10}}{7\sqrt{10}}\times\begin{pmatrix}21\\-7\end{pmatrix}=\begin{pmatrix}3\\-1\end{pmatrix}$ So $Q=(-1-3,-1--1)$ $Q=(-4,0)$	{M1} {M1,M1} {M1} {A1} {A1}
(d)(i)	$AB=\sqrt{(3+4)^2+(11+10)^2}=7\sqrt{10}$ $RQ=\sqrt{(-11+4)^2+(-21)^2}=7\sqrt{10}$	M1 A1
(d)(ii)	Gradient of $RQ=\dfrac{-21-0}{-11+4}=3$ So Gradient of AB (=3) = Gradient of RQ	M1 A1 (4)

ALT (d)	Using Vectors	
	$\overrightarrow{RQ}=\begin{pmatrix}-4-(-11)\\0-(-21)\end{pmatrix}=\begin{pmatrix}7\\21\end{pmatrix}$	{M1} {A1}
	$\overrightarrow{AB}=\begin{pmatrix}7\\21\end{pmatrix}=\overrightarrow{RQ}$	{M1}
	Because the vectors are the same they must be parallel and the same length	{A1}
(e)	Area = $7\sqrt{10}\times\sqrt{10}=70$	M1 A1 (2)
ALT (e)	Using Vectors	
	$\frac{1}{2}\begin{vmatrix}3 & -4 & -11 & -4 & 3\\11 & 10 & -21 & 0 & 11\end{vmatrix}$	{M1}
	$=70$	{A1}
	Total is 16 marks	

Part	Mark	Guidance
(a)	M1	For a fully correct method of finding an equation of a straight line. $\frac{y-y_1}{y_2-y_1}=\frac{x-x_1}{x_2-x_1}\Rightarrow\frac{y-(-10)}{11-(-10)}=\frac{x-(-4)}{3-(-4)}$ Or finds gradient $\frac{11+10}{3+4}=3$ and uses $y+10=3(x+4)$ or $y-11=3(x-3)$ If $y=mx+c$ is used, they must find a complete equation for this mark. Allow **one** error only for the award of this mark.
	A1	For a correct line in any form. $y+10=3(x+4)$ or $y-11=3(x-3)$ or $y=3x+2$ or even $\frac{y+10}{21}=\frac{x+4}{7}$ but do not allow incomplete processing.
(b)	M1	For one correct from $x=-1$ or $y=-1$
	A1	For the correct coordinates of point P $(-1,-1)$ Accept $x=-1$ $y=-1$
(c)	M1	Uses the perpendicular gradient to set up an equation in m and n. $-\frac{1}{'3'}=\frac{n-'(-1)'}{m-'(-1)'}\Rightarrow-\frac{1}{'3'}(m+1)=n+1$ or $n=-\frac{1}{3}m-\frac{4}{3}$ Ft their gradient in part (a) and their P from part (b) for this mark.
	M1	Uses Pythagoras theorem to set up an equation in m and n. $\left(\sqrt{10}\right)^2=\left(m-'(-1)'\right)^2+\left(n-'(-1)'\right)^2$ Ft their coordinates of point P form part (b) for this mark.
	M1	Attempts to solve their two equations in n and m simultaneously and forms a quadratic equation in one variable only. $10=(m+1)^2+\frac{1}{9}(m+1)^2\Rightarrow9=(m+1)^2$ or $0=m^2+2m-8$ or $10=9(n+1)^2+(n+1)^2\Rightarrow0=10n^2+20n$
	M1	For solving their either: $9=(m+1)^2\Rightarrow m=...$ or $0=10n^2+20n\Rightarrow n=...$ which must be a quadratic equation.
	A1	For finding **either** $m=-4$ **or** $n=0$ Condone the sight of $m=2$ for this mark.
	A1	For finding **both** $m=-4$ **and** $n=0$ $\Rightarrow(-4,\ 0)$ The final answer must be given as coordinates.
	ALT – using vectors – see main scheme.	
(d)(i)	M1	For finding **either** the length $AB=\sqrt{(3+4)^2+(11+10)^2}=7\sqrt{10}$ **Or** $RQ=\sqrt{(-11+4)^2+(-21)^2}=7\sqrt{10}$
	A1	For finding **both** the length $AB=\sqrt{(3+4)^2+(11+10)^2}=7\sqrt{10}$ **And** $RQ=\sqrt{(-11+4)^2+(-21)^2}=7\sqrt{10}$ **and** states they are equal
(d)(ii)	M1	The gradient of $RQ=\frac{-21-'0'}{-11-'(-4)'}='3'$ Ft their coordinates from part (c)

	A1	States that the gradient of RQ = gradient of AB [from (a)]
	ALT – Uses vectors, see main scheme. Ft their coordinates of $Q-(m, n)$	
(e)	**M1**	For a correct expression for the area using their length of AB and the given length of PQ $\left(\sqrt{10}\right)$ Area = $'7\sqrt{10}'\times\sqrt{10}=\ldots$
	A1	For the area = 70 [square units]
	ALT – Uses the discriminant	
	M1	For a correct expression of the area in sequential order using their coordinates for Q Area = $\frac{1}{2}\begin{vmatrix} 3 & -4 & -11 & '-4' & 3 \\ 11 & 10 & -21 & '0' & 11 \end{vmatrix}$
	A1	Area = 70 [square units]

Useful sketch