Question	Scheme	Marks
8(a)	$\frac{y-5}{5-9}=\frac{x-1}{1-9}$ $\Rightarrow x-2y+9=0$	M1A1 A1 [3]
(b)	<u>Coordinates of point *X*</u> $\left(\frac{3\times9+1\times1}{3+1},\frac{3\times9+1\times5}{3+1}\right)=(7,8)$ The perpendicular gradient = $-\frac{1}{\frac{1}{2}}=-2$ Equation of *l* $y-8=-2(x-7)\Rightarrow y=-2x+22$ *	B1B1 B1ft M1A1 cso [5]
(c)	$y=-2(6)+22\Rightarrow p=10$	B1 [1]
(d)	$\overrightarrow{BA}=\begin{pmatrix}1-9\\5-9\end{pmatrix}=\begin{pmatrix}-8\\-4\end{pmatrix}\Rightarrow\overrightarrow{CD}=\begin{pmatrix}6-8\\10-4\end{pmatrix}=\begin{pmatrix}-2\\6\end{pmatrix}$ and coordinates of *C* are (6, 10) so coordinates of *D* are (– 2, 6)	M1 A1A1 [3]
(e)	Length of *AB* (or *CD*) = $\sqrt{(9-5)^2+(9-1)^2}=\sqrt{80}$ Length of *CX* = $\sqrt{(10-8)^2+(7-6)^2}=\sqrt{5}$ Area of parallelogram *ABCD* = $\sqrt{5}\times\sqrt{80}=\sqrt{400}=20$ (units^2)	B1 B1 M1A1 [4]
		Total 16 marks

Part	Mark	Notes
(a)	M1	For using a correct method and the given coordinates of *A* and *B* to form the equation of *AB*. Do not score this mark until they find the gradient and form the equation of the line using a correct formula. If they use $y=mx+c$ do not allow this mark until they find *c* and form a complete equation. $\left[m=\frac{1}{2},\quad c=\frac{9}{2}\quad y=\frac{x}{2}+\frac{9}{2}\right]$
	A1	For the correct equation of *AB* in any form.
	A1	For the correct equation of *AB* in the required form.

(b)	B1	For either x or y correct coordinates of point X **NB This is an M mark in Epen**
	B1	For both x and y correct coordinates of point X **NB This is an A mark in Epen.**
	B1ft	For writing down the inverse reciprocal of their gradient for AB Ft their gradient form part (a)
	M1	For forming an equation for l using their coordinates of X and their negative reciprocal gradient of AB $y-8=-2(x-7)\Rightarrow y=-2x+22$
	A1	For the correct equation of l as shown.
(c)	B1	For $y = 10$
(d)	M1	For a suitable method. **Method 1 - Uses vectors:** $\overrightarrow{BA}=\begin{pmatrix}1-9\\5-9\end{pmatrix}=\begin{pmatrix}-8\\-4\end{pmatrix}\Rightarrow \overrightarrow{CD}=\begin{pmatrix}6+(-8)\\10+(-4)\end{pmatrix}\Rightarrow\left[\begin{pmatrix}-2\\6\end{pmatrix}\right]$ OR: $\overrightarrow{BC}=\begin{pmatrix}6-9\\9-10\end{pmatrix}=\begin{pmatrix}-3\\-1\end{pmatrix}\Rightarrow \overrightarrow{AD}=\begin{pmatrix}1-3\\5-(-1)\end{pmatrix}\Rightarrow\left[\begin{pmatrix}-2\\6\end{pmatrix}\right]$ **Method 2 - Uses simultaneous equations**: The equation of AD is $y=-\frac{x}{3}+\frac{16}{3}$ and of CD is $y=\frac{x}{2}+7$ $-\frac{x}{3}+\frac{16}{3}=\frac{x}{2}+7\Rightarrow x=-2$ and $y=6$ **Method 3 - Uses the gradient and length of *AB* or *CD*** $AB=CD=4\sqrt{5}=\sqrt{(6-x)^2+(y-10)^2}$ Gradient: $\frac{1}{2}=\frac{10-y}{6-x}\Rightarrow x=2y-14$ $\left(4\sqrt{5}\right)^2=\left(6-(2y-14)\right)x^2+(y-10)^2\Rightarrow 5y^2-100y+420=0$ $\Rightarrow y=6,14$ and $x=-2,14$ Allow no more than one error in either method.
	A1	For either correct x or y coordinate of D [(– 2, 6)] **NB** this is an A mark in Epen
	A1	For both correct coordinates of D (– 2, 6)

(e)	B1	For the correct length of either ***AB* [*CD*] or *CX*** These are given coordinates there is no ft
	B1	For the correct lengths of both ***AB* [*CD*] and *CX*** Ft their C and their X
	M1	For using a correct method to calculate the area of a parallelogram. $\text{b} \times \text{h} = CX \times AB = \sqrt{5} \times \sqrt{80} = \sqrt{400} = 20$ If their lengths are incorrect allow this mark provided their lengths are identified as base and perpendicular height. If they use AD as the base $\left[\sqrt{10}\right]$, the perpendicular height required is $2\sqrt{10}$ so base × height = $\sqrt{10} \times 2\sqrt{10} = ...$
	A1	For the correct area of 20 [units^2]
	ALT – Using determinants	
	B1B1	For sight of the correct array which must use the coordinates of *A, B, C* and *D* **ONLY.** The coordinates (7, 8) seen in the array is B0B0 $\begin{pmatrix} 1 & 9 & '6' & '-2' & 1 \\ 5 & 9 & '10' & '6' & 5 \end{pmatrix}$ Award both marks for fully correct. Award B1 if there are no more than 2 errors but with none missing. There must be 5 sets of coordinates in the array with first and last the same. **The coordinates must go in order around the parallelogram clockwise or anticlockwise.**
	M1	For the correct evaluation of their 2×5 array. Allow this even if they have (7, 8) included instead of (9, 9) [which is a common error] $\frac{1}{2}\begin{pmatrix} 1 & 9 & 6 & -2 & 1 \\ 5 & 9 & 10 & 6 & 5 \end{pmatrix} = \frac{1}{2}\left\|\left[(9+90+36-10)-(45+54-20+6)\right]\right\| = ...$
	A1	For the correct area of 20 [units^2]

Useful sketch