Question	Scheme	Marks	AOs
15	$\overrightarrow{OA}=\begin{pmatrix}-3\\2\\7\end{pmatrix}$, $\overrightarrow{OB}=\begin{pmatrix}3\\-1\\p\end{pmatrix}$, $\overrightarrow{BC}=\begin{pmatrix}0\\6\\-7\end{pmatrix}$, $\overrightarrow{AD}=\begin{pmatrix}2\\5\\-4\end{pmatrix}$; p is a constant		
(a)	$\left\{\overrightarrow{OD}=\overrightarrow{OA}+\overrightarrow{AD}=\begin{pmatrix}-3\\2\\7\end{pmatrix}+\begin{pmatrix}2\\5\\-4\end{pmatrix}\Rightarrow\right\}\ \overrightarrow{OD}=\begin{pmatrix}-1\\7\\3\end{pmatrix}$	B1	1.1b
		(1)	
(b)	$\overrightarrow{OC}=\overrightarrow{OB}+\overrightarrow{BC}=\begin{pmatrix}3\\-1\\p\end{pmatrix}+\begin{pmatrix}0\\6\\-7\end{pmatrix}=\begin{pmatrix}3\\5\\p-7\end{pmatrix}$	M1	3.1a
	$\overrightarrow{DC}=\overrightarrow{OC}-\overrightarrow{OD}=\begin{pmatrix}3\\5\\p-7\end{pmatrix}-\begin{pmatrix}-1\\7\\3\end{pmatrix}=\begin{pmatrix}4\\-2\\p-10\end{pmatrix}$	A1	1.1b
	$\overrightarrow{AB}=\overrightarrow{OB}-\overrightarrow{OA}=\begin{pmatrix}3\\-1\\p\end{pmatrix}-\begin{pmatrix}-3\\2\\7\end{pmatrix}=\begin{pmatrix}6\\-3\\p-7\end{pmatrix}$ so $\overrightarrow{AB}=1.5\overrightarrow{DC}\Rightarrow\ p-7=1.5(p-10)$	M1	3.1a
	$p-7=1.5p-15\Rightarrow 8=0.5p\Rightarrow p=16$	A1	1.1b
		(4)	
		(5 marks)	

Question 15 Notes:

(a)	
B1:	$\left\{\overrightarrow{OD}\right\}=\begin{pmatrix}-1\\7\\3\end{pmatrix}$
(b)	
M1:	Complete strategy for finding the vector $\overrightarrow{DC}$ or $\overrightarrow{CD}$ (e.g. finding $\overrightarrow{OC}$ followed by $\overrightarrow{DC}$)
A1:	For either $\left\{\overrightarrow{DC}\right\}=\begin{pmatrix}4\\-2\\p-10\end{pmatrix}$ or $\left\{\overrightarrow{CD}\right\}=\begin{pmatrix}-4\\2\\-p+10\end{pmatrix}$
M1:	Complete strategy of • finding the vector $\overrightarrow{AB}$ (or $\overrightarrow{BA}$) • discovering that $\overrightarrow{AB}$ (or $\overrightarrow{BA}$) is parallel to $\overrightarrow{DC}$ (or $\overrightarrow{CD}$) and so writes an equation of the form (their **k** component in terms of p of $\pm\overrightarrow{AB}$) $=\delta$(their **k** component in terms of p of $\pm\overrightarrow{DC}$), where $\delta\neq 1$ is a constant
A1:	Correct solution leading to $p=16$