Question	Scheme	Marks	AOs
4.	$(\mathbf{r}=)\begin{pmatrix}-2+\lambda\\5-\lambda\\4-3\lambda\end{pmatrix}$ **or** $\begin{pmatrix}-2\\5\\4\end{pmatrix}+\lambda\begin{pmatrix}1\\-1\\-3\end{pmatrix}$ (oe)	M1	1.1b
	So meet if $\begin{pmatrix}-2+\lambda\\5-\lambda\\4-3\lambda\end{pmatrix}\bullet\begin{pmatrix}1\\-2\\1\end{pmatrix}=-7\Rightarrow(-2+\lambda)\times1+(5-\lambda)\times-2+(4-3\lambda)\times1=-7$	M1 A1	3.1a 1.1b
	$\Rightarrow 0\lambda-8=-7\Rightarrow-8=-7$ a contradiction so no intersection	A1ft	2.3
	Hence l is parallel to Π but not in it.	A1cso	3.2a
		(5)	
			(5 marks)

Notes

M1 Forms a parametric form for the line. Allow one slip.

M1 Substitutes into the equation of the plane to an equation in λ. May use Cartesian form of plane to substitute into.

A1 Correct equation in λ

A1ft Simplifies and derives a contradiction and deduces line and plane do not meet. Follow through in their initial equation in λ so
- contradiction so no intersection if λ disappears and constants unequal
- line lies in plane if a tautology is arrived at
- meet in a point if a solution for λ is found.

But do not allow for incorrect simplification from a correct initial equation in λ

Note that a miscopy/misread of 7 instead of −7 can therefore score a maximum of M1M1A0A1A0.

A1cso Correct deduction from correct working. This may be seen two separate statements in their working. You may see attempts at showing the line is parallel before/after deducing there is no intersection.

Alt 1	Note that some may a attempt a mix of the main scheme and Alt 1. Mark under main scheme unless Alt 1 would score higher.		
	$\begin{pmatrix}1\\-1\\-3\end{pmatrix}\bullet\begin{pmatrix}1\\-2\\1\end{pmatrix}=1\times1+(-1)\times(-2)+(-3)\times1=0$	M1	3.1a
	Hence l is parallel to Π	A1	1.1b
	$(-2,5,4)$ on l, but $(1)(-2)+(-2)(5)+1(4)=-8$	M1	1.1b
	$-8\neq-7$ so $(-2,5,4)$ is not on the plane.	A1ft	2.3
	Hence l is (parallel to Π but) not in the plane.	A1cso	3.2a
		(5)	
			(5 marks)

Alt 1 Notes

M1 Attempts the dot product between the two direction vectors.

A1 Shows dot product is zero and makes the correct deduction that line is parallel to plane.

M1 Finds a point on l and substitutes into the equation of Π (vector or Cartesian)

A1ft Simplifies and derives a contradiction – follow through their equation, so if arrive at a tautology, they should deduce the line is in the plane.

A1cso Correct deduction from correct working but may be split across working.

Question	Scheme	Marks	AOs
Alt 2	Attempts to solve $\frac{x+2}{1}=\frac{y-5}{-1}=\frac{z-4}{-3}$ and $x-2y+z=-7$ simultaneously – eliminates one variable for M mark.	M1	3.1a
	e.g. $y=-(x+2)+5=-x+3 \Rightarrow x-2(-x+3)+z=-7 \Rightarrow 3x+z=-1$ (oe)	A1	1.1b
	Solves reduced equations, e.g. $-3(x+2)=z-4 \Rightarrow 3x+z=-2$ and $3x+z=-1 \Rightarrow (3x+z)-(3x+z)=-2-(-1)$	M1	1.1b
	$\Rightarrow 0=-1$ a contradiction so no intersection	A1ft	2.3
	Hence l is parallel to Π but not in it.	A1cso	3.2a
		(5)	
			(5 marks)

Alt 2 notes

M1 Attempts to solve the Cartesian equation of the line and plane, using the plane equation to eliminate one variable for the M.

A1 Correct elimination of their chosen variable. (E.g may see $3-3y+z=-7$ or $-2x-2y-2=-7$ etc)

M1 Solves the reduced equations in two variables…

A1ft … and derives a contradiction/line and plane do not meet. Follow through their result, so may reach a tautology and deduce lies in plane, or find single solution and deduce meet in a point.

A1cso Correct deduction from correct working.