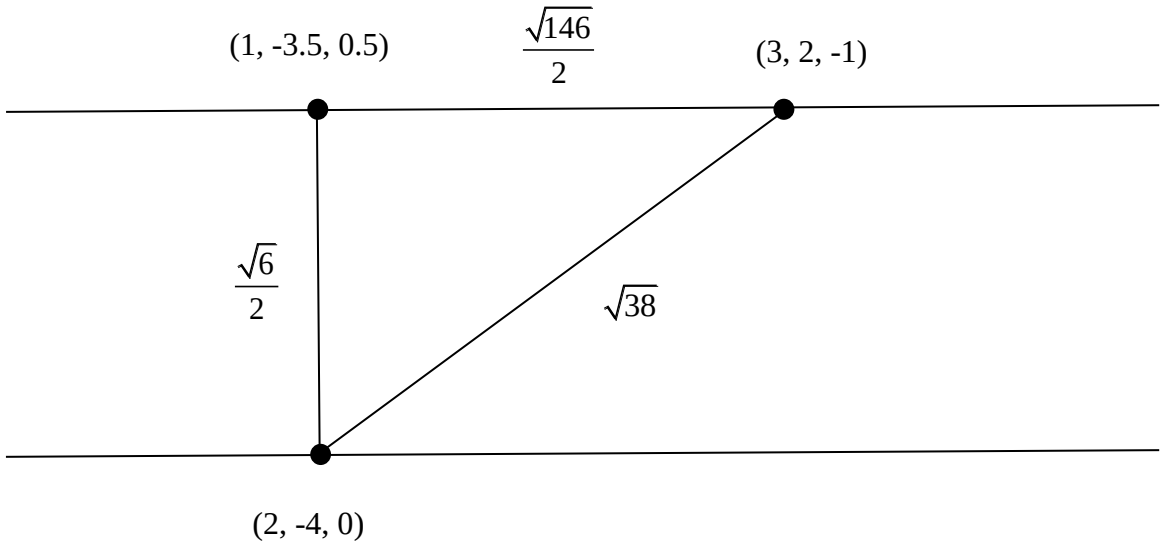
Question Number	Scheme		Marks
5(a)	$(\mathbf{i}+2\mathbf{k})\times(2\mathbf{i}+\mathbf{j}+3\mathbf{k})=\mathbf{i}(0-2)-\mathbf{j}(3-4)+\mathbf{k}(1-0)$ Attempt the correct vector product between the direction vectors If no method is shown at least 2 "components" should be correct		M1
	$-2\mathbf{i}+\mathbf{j}+\mathbf{k}$	Any multiple of this vector	A1
			(2)
(a) **Way 2**	$\mathbf{n}=\begin{pmatrix}1\\a\\b\end{pmatrix}\Rightarrow\begin{pmatrix}1\\a\\b\end{pmatrix}\bullet\begin{pmatrix}1\\0\\2\end{pmatrix}=0,\begin{pmatrix}1\\a\\b\end{pmatrix}\bullet\begin{pmatrix}2\\1\\3\end{pmatrix}=0\Rightarrow a=-\frac{1}{2},b=-\frac{1}{2}$ Correct method leading to values for a and b		M1
	$-2\mathbf{i}+\mathbf{j}+\mathbf{k}$	Any multiple of this vector	A1

Useful Diagram:



Mark (b) and (c) together

(b)	l has direction $\mathbf{i}+6\mathbf{j}-\mathbf{k}$	Any multiple of this vector	B1
	$(\mathbf{i}+6\mathbf{j}-\mathbf{k})\bullet(-2\mathbf{i}+\mathbf{j}+\mathbf{k})=-2+6-1$	Attempts scalar product between the direction of l and the normal to the plane.	M1
	$\sin\alpha$ or $\cos(90°-\alpha)=\dfrac{-2+6-1}{\sqrt{6}\times\sqrt{38}}$ $\left(\text{NB } \sqrt{6}\times\sqrt{38}=2\sqrt{57}\right)$	sin... or cos... $=\pm\left(\dfrac{-2+6-1}{\sqrt{6}\times\sqrt{38}}\right)$	A1
	$\alpha=(11.45...=)11°$	For 11 (degrees symbol not required). **Do not isw and mark their final answer.**	A1
			(4)

(b) Way 2	l has direction $\mathbf{i}+6\mathbf{j}-\mathbf{k}$	Any multiple of this vector	B1
	$\lvert\mathbf{i}+6\mathbf{j}-\mathbf{k}\rvert=\sqrt{1^2+6^2+1^2}\left(=\sqrt{38}\right)$ Followed by a complete method to find the perpendicular distance from A to the plane i.e. as in part (c) $\left(\dfrac{3}{\sqrt{6}}\right)$ or finds the distance from (3, 2, -1) to the intersection of the perpendicular from A with the plane (1, -3.5, 0.5) $\left(\dfrac{\sqrt{146}}{2}\right)$ and then uses correct trigonometry to find the sin or cos or tan (would need both distances) to find the required angle.		M1
	$\sin\alpha=\dfrac{\frac{3}{\sqrt{6}}}{\sqrt{38}}$, $\cos\alpha=\dfrac{\frac{\sqrt{146}}{2}}{\sqrt{38}}$, $\tan\alpha=\dfrac{\frac{3}{\sqrt{6}}}{\frac{\sqrt{146}}{2}}$		A1
	$\alpha=(11.45...=)11°$	For 11 (degrees symbol not required). **Do not isw and mark their final answer.**	A1
(b) Way 3	l has direction $\mathbf{i}+6\mathbf{j}-\mathbf{k}$	Any multiple of this vector	B1
	$(\mathbf{i}+6\mathbf{j}-\mathbf{k})\times(-2\mathbf{i}+\mathbf{j}+\mathbf{k})=7\mathbf{i}+\mathbf{j}+13\mathbf{k}$ Attempts vector product between the direction of l and the normal to the plane. If no method is shown at least 2 "components" should be correct		M1
	$\sin\alpha=\dfrac{\sqrt{169+49+1}}{\sqrt{6}\times\sqrt{38}}$	Correct value for sin…	A1
	$\alpha=(11.45...=)11°$	For 11 (degrees symbol not required). **Do not isw and mark their final answer.**	A1

(c) Way 1	Π has equation: $\mathbf{r}.(-2\mathbf{i}+\mathbf{j}+\mathbf{k})=(4\mathbf{i}+2\mathbf{j}+\mathbf{k}).(-2\mathbf{i}+\mathbf{j}+\mathbf{k})=-5$ or $\mathbf{r}.(-2\mathbf{i}+\mathbf{j}+\mathbf{k})=(3\mathbf{i}+2\mathbf{j}-\mathbf{k}).(-2\mathbf{i}+\mathbf{j}+\mathbf{k})=-5$ M1: Forms scalar product of a point in the plane with their normal vector A1: Correct equation. Allow this mark if -5 (**or the equivalent multiple of -5 for their normal**) is obtained i.e. do not need to see the equation of the plane explicitly		M1A1
	$\mathbf{r}.(-2\mathbf{i}+\mathbf{j}+\mathbf{k})=(2\mathbf{i}-4\mathbf{j}).(-2\mathbf{i}+\mathbf{j}+\mathbf{k})=-8$ $\Rightarrow d=\left\lvert\frac{-8-(-5)}{\sqrt{2^2+1^2+1^2}}\right\rvert=...$		M1
	$d=\frac{\sqrt{6}}{2}$	Correct distance in any equivalent exact form e.g. $\frac{3}{\sqrt{6}}$	A1
			(4)
(c) Way 2	Dist (2, -4, 0) to $(3,2,-1)=\sqrt{(3-2)^2+(2+4)^2+1^2}=...$ Correct attempt to find the distance between (2, - 4, 0) and (3, 2, 1)		M1
	$=\sqrt{38}$	Correct distance	A1
	$\text{d} = "\sqrt{38}"\sin\alpha = "\sqrt{38}"\frac{3}{\sqrt{6}\times\sqrt{38}}=...$	Uses correct trigonometry to find the required distance	M1
	$d=\frac{\sqrt{6}}{2}$	Correct distance in any equivalent exact form e.g. $\frac{3}{\sqrt{6}}$	A1
(c) Way 3	Π has equation: $\mathbf{r}.(-2\mathbf{i}+\mathbf{j}+\mathbf{k})=(4\mathbf{i}+2\mathbf{j}+\mathbf{k}).(-2\mathbf{i}+\mathbf{j}+\mathbf{k})=-5$ or $\mathbf{r}.(-2\mathbf{i}+\mathbf{j}+\mathbf{k})=(3\mathbf{i}+2\mathbf{j}-\mathbf{k}).(-2\mathbf{i}+\mathbf{j}+\mathbf{k})=-5$ M1: Forms scalar product of a point in the plane with their normal vector A1: Correct equation. Allow this mark if -5 (**or the equivalent multiple of -5 for their normal**) is obtained i.e. do not need to see the equation of the plane explicitly		M1A1
	$\Rightarrow d=\left\lvert\frac{-2\times2+1(-4)+(0)+5}{\sqrt{2^2+1^2+1^2}}\right\rvert=...$	Uses a correct formula for the distance. (Allow ± their -5)	M1
	$d=\frac{\sqrt{6}}{2}$	Correct distance in any equivalent exact form e.g. $\frac{3}{\sqrt{6}}$	A1

(c) **Way 4**	Let P be (3, 2, -1) so $\mathbf{AP} = \mathbf{i} + 6\mathbf{j} - \mathbf{k}$ $(\mathbf{i}+6\mathbf{j}-\mathbf{k})\bullet(-2\mathbf{i}+\mathbf{j}+\mathbf{k}) = -2+6-1$ M1: Forms the vector AP and calculates scalar product with normal vector A1: Correct scalar product for their normal i.e. 3 or a multiple of 3 depending on their normal (may be unsimplified)		M1A1
	$\Rightarrow d = \left\|\frac{-2+6-1}{\sqrt{2^2+1^2+1^2}}\right\| = ...$	Uses a correct formula for the distance.	M1
	$d = \frac{\sqrt{6}}{2}$	Correct distance in any equivalent exact form e.g. $\frac{3}{\sqrt{6}}$	A1
(c) **Way 5**	Π has equation: $\mathbf{r}.(-2\mathbf{i}+\mathbf{j}+\mathbf{k}) = (4\mathbf{i}+2\mathbf{j}+\mathbf{k}).(-2\mathbf{i}+\mathbf{j}+\mathbf{k}) = -5$ or $\mathbf{r}.(-2\mathbf{i}+\mathbf{j}+\mathbf{k}) = (3\mathbf{i}+2\mathbf{j}-\mathbf{k}).(-2\mathbf{i}+\mathbf{j}+\mathbf{k}) = -5$ M1: Forms scalar product of a point in the plane with their normal vector A1: Correct equation Allow this mark if -5 (**or the equivalent multiple of -5 for their normal**) is obtained i.e. do not need to see the equation of the plane explicitly		M1A1
	$(2\mathbf{i}-4\mathbf{j})+\lambda(-2\mathbf{i}+\mathbf{j}+\mathbf{k})$, $2x-y-z=5$ $\Rightarrow 4-4\lambda+4-\lambda-\lambda=5 \Rightarrow \lambda = \frac{1}{2}$ $\Rightarrow d = \frac{1}{2}\left\|-2\mathbf{i}+\mathbf{j}+\mathbf{k}\right\| = \frac{\sqrt{2^2+1^1+1^2}}{2}$ Requires a complete method: Uses the parametric form of the line through (-2, 4, 0) perpendicular to the plane and substitutes into the equation of the plane to find the value of the parameter and uses this correctly to find the required distance.		M1
	$d = \frac{\sqrt{6}}{2}$	Correct distance in any equivalent exact form e.g. $\frac{3}{\sqrt{6}}$	A1
			[10]