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PA#2B- §12.5: Lines and Planes

Consider the planes $x + 2y - z = 4$ and $2x - y + z = 1$. Explain in a few words why the planes must intersect. Then, find the line which passes through the point $P(1, 1, 1)$ and is parallel to the line of intersection of the two planes.

$\vec{n}_1 = \langle 1, 2, -1 \rangle$ normal vector of first plane

$\vec{n}_2 = \langle 2, -1, 1 \rangle$ normal vector of second plane

Notice planes intersect since $\vec{n}_1 \neq \vec{n}_2$ are
NOT PARALLEL.

Line of intersection is $\ell(t) = \vec{OP} + t\vec{v}$, $t \in \mathbb{R}$

w/ $P(1, 1, 1)$ and $\vec{v} = \vec{n}_1 \times \vec{n}_2$.

$$\text{So } \vec{v} = \langle 1, 2, -1 \rangle \times \langle 2, -1, 1 \rangle$$

$$= \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & 2 & -1 \\ 2 & -1 & 1 \end{vmatrix} = \hat{i}(2-1) - \hat{j}(1+2) + \hat{k}(-1-4) \\ = \langle 1, -3, -5 \rangle$$

So

$$\ell(t) = \langle 1, 1, 1 \rangle + t\langle 1, -3, -5 \rangle, t \in \mathbb{R}$$

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G2:

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G3:

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