Step-1

Given that the equations of two planes are $x+y+3z=6 \text{ and } x-y+z=4$

We have to find a point with $z=2$ on the intersection line of the given planes; we have to find a point with $z=0$ on the intersection line of the given planes, and we have to find a third point halfway between these two.

Step-2

When $z=2$ the equations becomes,

$x+y=0$
$x-y=2$

The column vector of the above equations is

$$x\begin{pmatrix}1\\1\end{pmatrix}+y\begin{pmatrix}1\\-1\end{pmatrix}=\begin{pmatrix}0\\2\end{pmatrix}$$

Step-3

The linear combination for the vectors is $1(\text{first column})+(-1)(\text{second column})$ that gives right hand side vector and for taking $z=2$, the required point is $\boxed{(1,-1,2)}$

Step-4

When $z=0$ the equations becomes,

$x+y=6$
$x-y=4$

The column vector of the above equations is

$$x\begin{pmatrix}1\\1\end{pmatrix}+y\begin{pmatrix}1\\-1\end{pmatrix}=\begin{pmatrix}6\\4\end{pmatrix}$$

Step-5

The linear combination for the vectors is $5(\text{first column})+1(\text{second column})$ that gives right hand side vector and by taking $z=0$, the required point is $\boxed{(5,1,0)}$

Step-6

The point that is half way between $(1,-1,2)$ and $(5,1,0)$ is $\boxed{(3,0,1)}$

Since it is the mid point of the points $(1,-1,2)$ and $(5,1,0)$