ex. $x + 2y - z = 3$
$2x + y + z = 1$

$$\left[\begin{array}{cccc} 1 & 2 & -1 & 3 \\ 2 & 1 & 1 & \end{array}\right] \to \left[\begin{array}{cccc} 1 & 2 & -1 & 3 \\ & -1 & 3 & -5 \end{array}\right]$$

$$\to \left[\begin{array}{cccc} 1 & 0 & 5 & -7 \\ 0 & 1 & -3 & 5 \end{array}\right]$$

$\to x + 5z = -7$
$y - 3z = 5$

$x = -7 - 5t,\ y = 5 + 3t,\ z = t$

$$\to \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} -7 \\ 5 \\ 0 \end{bmatrix} + t\begin{bmatrix} -5 \\ 3 \\ 1 \end{bmatrix}$$

ex. Let $p = \begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix}$, $q = \begin{bmatrix} 0 \\ 2 \\ 1 \end{bmatrix}$, $u = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$,

$v = \begin{bmatrix} 3 \\ -1 \\ -1 \end{bmatrix}$. Determine whether the lines $x = p + tu$ and $x = q + tv$ intersect.