Problem Statement:
To verify whether the lines passing through the given set of points are parallel or not

Theory:
Let the lines be parallel and the first two points pass through $n^T\mathbf{x} = c1$ i.e.

$$n^T x_1 = c_1 => x_1^T n = c_1 \tag{1}$$
$$n^T x_2 = c_2 => x_2^T n = c_2 \tag{2}$$

and the second two points pass through $n^T\mathbf{x} = c2$ Then

$$n^T x_3 = c_3 => x_3^T n = c_3 \tag{3}$$
$$n^T x_4 = c_4 => x_4^T n = c_4 \tag{4}$$

Putting all the equations together, we obtain

$$\begin{pmatrix} x_1^T \\ x_2^T \\ x_3^T \\ x_4^T \end{pmatrix} \vec{n} = \begin{pmatrix} c_1 \\ c_2 \\ c_3 \\ c_4 \end{pmatrix} \tag{5}$$

Now if this equation has a solution, then $\vec{n}$ exists and the lines will be parallel.

Example:
Given the points, $\mathbf{A} = \begin{pmatrix} 4 \\ 7 \\ 8 \end{pmatrix}, \mathbf{B} = \begin{pmatrix} 2 \\ 3 \\ 4 \end{pmatrix}, and \quad \mathbf{C} = \begin{pmatrix} -1 \\ -2 \\ 1 \end{pmatrix}, \mathbf{D} = \begin{pmatrix} 1 \\ 2 \\ 5 \end{pmatrix}$
Applying the row reduction procedure on the coefficient matrix:

$$\begin{pmatrix} 4 & 7 & 8 \\ 2 & 3 & 4 \\ -1 & -2 & 1 \\ 1 & 2 & 5 \end{pmatrix} \xrightarrow[r_3+r_4]{r_1-2r_2} \begin{pmatrix} 4 & 7 & 8 \\ 0 & 1 & 0 \\ -1 & -2 & 1 \\ 0 & 0 & 6 \end{pmatrix} \xrightarrow[r_3-6r_4]{r_1-7r_2} \begin{pmatrix} 4 & 0 & 8 \\ 0 & 1 & 0 \\ -1 & -2 & 0 \\ 0 & 0 & 6 \end{pmatrix} \xrightarrow[r_1-8r_4]{r_4/6} \begin{pmatrix} 4 & 0 & 0 \\ 0 & 1 & 0 \\ -1 & -2 & 1 \\ 0 & 0 & 1 \end{pmatrix}$$
$$\xrightarrow[r_3+r_4]{-r_3-2r_2} \begin{pmatrix} 4 & 0 & 0 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{pmatrix} \xrightarrow{r_1-4r_3} \begin{pmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

Here, the number of non-zero rows are three and hence the rank of the matrix is 3 which implies that the solution exists. Therefore the lines passing through A, B and C, D are parallel.