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Q1:- Sol. Given that:

$$\begin{bmatrix} 1 & ID_2 & 3 & 0 & 5 \\ 0 & 1 & -IDLast & 0 & 7 \\ 0 & 0 & 1 & 0 & -6 \\ 0 & 0 & 0 & 1 & ID_1 \end{bmatrix}$$

$ID_2 = 3, \quad IDLast = 5$

$$\begin{bmatrix} 1 & 3 & 3 & 0 & 5 \\ 0 & 1 & -5 & 0 & 7 \\ 0 & 0 & 1 & 0 & -6 \\ 0 & 0 & 0 & 1 & 3 \end{bmatrix}$$

By using elementary row operations,

$$\left[\begin{array}{ccccc|ccccc} 1 & 3 & 3 & 0 & 5 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & -5 & 0 & 7 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & -6 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 3 & 0 & 0 & 0 & 1 & 0 \end{array}\right]$$

$R_1 - 3R_2$

$$\left[\begin{array}{ccccc|cccc} 1 & 0 & 18 & 0 & -16 & 1 & -3 & 0 & 0 \\ 0 & 1 & -5 & 0 & 7 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & -6 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 3 & 0 & 0 & 0 & 1 \end{array}\right]$$

$R_1 - 18R_3$
$R_2 + 5R_3$

$$\left[\begin{array}{ccccc|cccc} 1 & 0 & 0 & 0 & +92 & 1 & -3 & -18 & 0 \\ 0 & 1 & 0 & 0 & -23 & 0 & 1 & 5 & 0 \\ 0 & 0 & 1 & 0 & -6 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 3 & 0 & 0 & 0 & 1 \end{array}\right]$$

$$\begin{pmatrix} 92 \\ -23 \\ -6 \\ 3 \end{pmatrix}$$

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Q2:- (a) Sol: $\begin{bmatrix} 1 & 3 & -1 & 5 \\ 0 & 1 & -4 & 2 \\ 0 & +2 & -5 & -1 \end{bmatrix}$

using elementary row operations,

R_3-2R_2 $\begin{bmatrix} 1 & 3 & -1 & 5 \\ 0 & 1 & -4 & 2 \\ 0 & 0 & 3 & -5 \end{bmatrix}$

Similarly for R_3+2R_2 $\begin{bmatrix} 1 & 3 & -1 & 5 \\ 0 & 1 & -4 & 2 \\ 0 & 0 & +3 & -5 \end{bmatrix}$

$\begin{bmatrix} 1 & 3 & -1 & 5 \\ 0 & 1 & -4 & 2 \\ 0 & 2 & -5 & -1 \end{bmatrix}$

so R_3-2R_2 is a inverse row operation of R_3+2R_2-

(b) Sol: (a). $\begin{bmatrix} e & 0 & 0 & 0 \\ 0 & \pi & 0 & 0 \\ 0 & 0 & -\pi & 0 \\ 0 & 0 & 0 & e \end{bmatrix}$

Yes, it is a echelon from of matrix because each pivot value below and above zero entry exists-

(b). $\begin{bmatrix} 1 & 0 & \pi \\ 0 & 1 & e \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$

Sol: No, it is not an echelon form of matrix because in 3rd row there is not pivot value exist-

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(c) $\begin{bmatrix} 5 & 0 & 0 & 7 \\ 0 & 1 & 0 & 5 \\ 0 & 0 & 1 & 4 \end{bmatrix}$

No, its not an reduce echelon matrix because each pivot value must be equal to 1.

(d) $\begin{bmatrix} 1 & 0 & 0 & 7 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 4 \end{bmatrix}$

No, because in 2nd row there is no pivot value exists.

Q3 (a) Sol: Row echelon form is achieved when one of the vectors is perfectly aligned with a declared axis. Reduce row echelon form is achieved when all the vectors is perfectly aligned with a declared axis.

(b) Sol:

$$\left[\begin{array}{ccc|ccc} 1 & 1 & 8 & 1 & 0 & 0 \\ 2 & 8 & -1 & 0 & 1 & 0 \\ -1 & 0 & 0 & 0 & 0 & 1 \\ 1 & -4 & 1 & 0 & 0 & 0 \end{array}\right]$$

$R_2 - 2R_1$, $R_3 + R_1$, $R_4 - R_1$

$$\left[\begin{array}{ccc|ccc} 1 & 1 & 8 & 1 & 0 & 0 \\ 0 & 6 & -17 & -2 & 1 & 0 \\ 0 & 1 & 8 & 1 & 0 & 1 \\ 0 & -5 & -7 & 1 & 0 & 0 \end{array}\right]$$

$R_1 - R_3$, $-5R_4 + R_3$

$$\left[\begin{array}{ccc|ccc} 1 & 0 & 0 & 0 & 0 & -1 \\ 0 & 6 & -17 & -2 & 1 & 0 \\ 0 & 1 & 8 & 1 & 0 & 1 \\ 0 & 0 & 43 & -4 & 0 & 1 \end{array}\right]$$

$6R_3 - R_2$

$$\left[\begin{array}{ccc|ccc} 1 & 0 & 0 & 0 & 0 & -1 \\ 0 & 6 & -17 & -2 & 1 & 0 \\ 0 & 0 & 65 & 8 & -1 & 6 \\ 0 & 0 & 43 & -4 & 0 & 1 \end{array}\right]$$

$\frac{R_4}{43}$

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$$\left[\begin{array}{ccc|ccc} 1 & 0 & 0 & 0 & 0 & -1 \\ 0 & 6 & -17 & -2 & 1 & 0 \\ 0 & 0 & 65 & 8 & -1 & 6 \\ 0 & 0 & 1 & \frac{-4}{43} & 0 & \frac{1}{43} \end{array}\right]$$

echelon form

$ID2 = 0$

$ID_3 = 8$

$ID\text{-First-Last} = \frac{1}{43}$ Ans