Matrix rank

7.1   Calculate matrix rank:

a) $\begin{bmatrix} 2 & -3 & 2 & 2 & 1 \\ 2 & 1 & -1 & 1 & 3 \\ 8 & -5 & 3 & 6 & 5 \end{bmatrix}$

b) $\begin{bmatrix} -2 & 1 & -3 & 1 & -5 \\ 9 & 3 & 6 & -12 & 15 \\ 5 & 3 & 2 & -8 & 7 \end{bmatrix}$

c) $\begin{bmatrix} 2 & 1 & 4 & 2 & 2 \\ 3 & 1 & 3 & 1 & 3 \\ 2 & 1 & 2 & 1 & 4 \\ 3 & 1 & 6 & 2 & 1 \end{bmatrix}$

d) $\begin{bmatrix} 1 & 2 & 3 & 4 & 5 \\ 6 & 7 & 8 & 9 & 10 \\ 11 & 12 & 13 & 14 & 15 \\ 16 & 17 & 18 & 19 & 20 \end{bmatrix}$

e) $\begin{bmatrix} -3 & 1 & 1 & 1 & 1 \\ 1 & -3 & 1 & 1 & 1 \\ 1 & 1 & -3 & 1 & 1 \\ 1 & 1 & 1 & -3 & 1 \\ 1 & 1 & 1 & 1 & -3 \end{bmatrix}$

7.2   Using the Kronecker-Capelli theorem check if the systems of equationas are consistent.

a) $\begin{cases} 2x - 2y + 4z + 2t = 2 \\ 3x + y + z - t = 2 \\ 5x - y + 5z + t = 4 \end{cases}$

b) $\begin{cases} 2x + 2y + z - t = 1 \\ -x + y + 3z - t = 2 \\ 5x + 3y - z - 4t \end{cases}$

c) $\begin{cases} 2x - 3y + 2z = 0 \\ 2x + y - z = 1 \\ 5x - y - z = 2 \\ 2x + 2y + 4z = 2 \\ x - 10y + 4z = -1 \end{cases}$

d) $\begin{cases} 2x_1 + x_2 - x_3 - 3x_4 = 2 \\ 2x_2 + 2x_3 + 6x_4 = 0 \\ 2x_1 + 3x_2 + x_3 + 3x_4 = 1 \\ x_1 - 2x_2 + x_3 + 2x_4 = -1 \end{cases}$