(1) [15] Use Gauss-Jordan elimination to solve the following system of equations:

$$3x + 4y - 7z = 10$$
$$x - 3y + 2z = -1$$
$$-x - 2y - z = -8$$

Clearly state the row operations used at each step of the reduction, and state a clear conclusion.

$$\begin{bmatrix} 3 & 4 & -7 & 10 \\ 1 & -3 & 2 & -1 \\ -1 & -2 & -1 & -8 \end{bmatrix}$$

$r_1 \leftrightarrow r_2$:

$$\begin{bmatrix} \textcircled{1} & -3 & 2 & -1 \\ 3 & 4 & -7 & 10 \\ -1 & -2 & -1 & -8 \end{bmatrix}$$

$R_2 = (-3)r_1 + r_2$:

$R_3 = r_1 + r_3$:

$$\begin{bmatrix} 1 & -3 & 2 & -1 \\ 0 & 13 & -13 & 13 \\ 0 & -5 & 1 & -9 \end{bmatrix}$$

$R_2 = \left(\frac{1}{13}\right) r_2$:

$$\begin{bmatrix} 1 & -3 & 2 & -1 \\ 0 & \textcircled{1} & -1 & 1 \\ 0 & -5 & 1 & -9 \end{bmatrix}$$

$R_3 = 5r_2 + r_3$:

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

$R_3 = \left(\frac{-1}{4}\right) r_3$:

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

$R_2 = r_3 + r_2$:

$R_1 = (-2)r_3 + r_1$:

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

$R_1 = (3)r_2 + r_1$:

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

$\therefore x = 3,\ y = 2,\ z = 1$