1. Consider the matrix below to be the augmented matrix of a system of linear equation

$$\left[\begin{array}{ccc|c} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \\ 9 & 0 & 1 & 2 \\ 3 & 4 & 5 & 6 \end{array}\right]$$

(a) Write the associated system of linear equations.

$$\begin{cases} 1x_1 + 2x_2 + 3x_3 = 4 \\ 5x_1 + 6x_2 + 7x_3 = 8 \\ 9x_1 + 0x_2 + 1x_3 = 2 \\ 3x_1 + 4x_2 + 5x_3 = 6 \end{cases}$$

(b) Define matrix $\boldsymbol{A}$ and vectors $\boldsymbol{x}$ and $\boldsymbol{b}$ so that the system of equations above can be represented as $\boldsymbol{Ax} = \boldsymbol{b}$

$$\boldsymbol{A} = \begin{bmatrix} 1 & 2 & 3 \\ 5 & 6 & 7 \\ 9 & 0 & 1 \\ 3 & 4 & 5 \end{bmatrix} \quad \boldsymbol{x} = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} \quad \boldsymbol{b} = \begin{bmatrix} 4 \\ 8 \\ 2 \\ 6 \end{bmatrix}$$

(c) Define vectors $\boldsymbol{a}_1$, $\boldsymbol{a}_2$, and $\boldsymbol{a}_3$ and then write the above system as a single vector equation.

$$\boldsymbol{a}_1 = \begin{bmatrix} 1x_1 \\ 5x_1 \\ 9x_1 \\ 3x_1 \end{bmatrix} \quad \boldsymbol{a}_2 = \begin{bmatrix} 2x_2 \\ 6x_2 \\ 0x_2 \\ 4x_2 \end{bmatrix} \quad \boldsymbol{a}_3 = \begin{bmatrix} 3x_3 \\ 4x_3 \\ 5x_3 \\ 6x_3 \end{bmatrix}$$

$$\boldsymbol{a}_1 + \boldsymbol{a}_2 + \boldsymbol{a}_3 = \boldsymbol{b}$$

2. Parametrize the solution set (write the general solution) to the equation $x + 2y + 3z = 5$ as a linear combination of vectors.

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 5 \\ 0 \\ 0 \end{bmatrix} + s \begin{bmatrix} -2 \\ 1 \\ 0 \end{bmatrix} + t \begin{bmatrix} -3 \\ 0 \\ 1 \end{bmatrix}$$