

**Instructions:** Show all work. Answer each question as completely as possible. Use exact values (yes, that means fractions!).

1. Write the following system of equations as a matrix equation, and then also as a vector equation.

$$\begin{cases} x_1 + 2x_2 - 5x_3 + 4x_4 = 16 \\ 5x_1 - 7x_2 + x_3 - 2x_4 = 20 \\ 3x_1 + x_2 - 4x_3 + 5x_4 = -17 \\ 2x_1 - 3x_2 - 2x_3 + 6x_4 = 24 \end{cases}$$

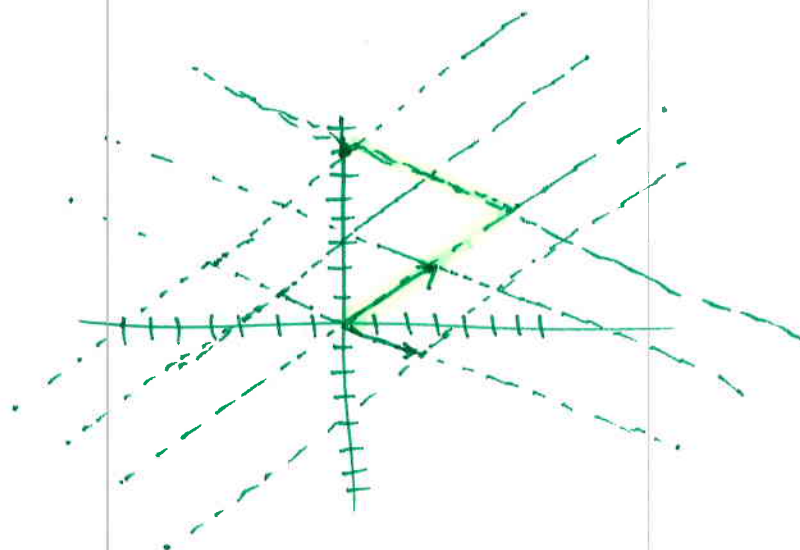
$$\begin{bmatrix} 1 & 2 & -5 & 4 \\ 5 & -7 & 1 & -2 \\ 3 & 1 & -4 & 5 \\ 2 & -3 & -2 & 6 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix} = \begin{bmatrix} 16 \\ 20 \\ -17 \\ 24 \end{bmatrix}$$

$$\begin{bmatrix} 1 \\ 5 \\ 3 \\ 2 \end{bmatrix} x_1 + \begin{bmatrix} 2 \\ -7 \\ 1 \\ -3 \end{bmatrix} x_2 + \begin{bmatrix} -5 \\ 1 \\ -4 \\ -2 \end{bmatrix} x_3 + \begin{bmatrix} 4 \\ -2 \\ 5 \\ 6 \end{bmatrix} x_4 = \begin{bmatrix} 16 \\ 20 \\ -17 \\ 24 \end{bmatrix}$$

matrix equation

vector equation

2. Consider the vector equation  $x_1 \begin{bmatrix} 3 \\ 2 \end{bmatrix} + x_2 \begin{bmatrix} 2 \\ -1 \end{bmatrix} = \begin{bmatrix} 0 \\ 7 \end{bmatrix}$ . Solve the system for  $x_1, x_2$  then draw the graph of the coordinate system and show how to represent the vector  $\begin{bmatrix} 0 \\ 7 \end{bmatrix}$  as a linear combination of  $\begin{bmatrix} 3 \\ 2 \end{bmatrix}, \begin{bmatrix} 2 \\ -1 \end{bmatrix}$ .



$$\begin{bmatrix} 0 \\ 7 \end{bmatrix} = 2 \begin{bmatrix} 3 \\ 2 \end{bmatrix} + (-3) \begin{bmatrix} 2 \\ -1 \end{bmatrix}$$