Let $\vec{u} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$ and $\vec{v} = \begin{bmatrix} -1 \\ 0 \end{bmatrix}$.

1. Graph the vectors $\vec{u}$, $\vec{v}$, and $2\vec{u} + \vec{v}$.
2. (a) Draw the set $A = \{\vec{x} \in \mathbb{R}^2 : \vec{x} = t\vec{u} \text{ for some } t \in \mathbb{R}\}$.
   (b) Draw the set $B = \{\vec{x} \in \mathbb{R}^2 : \vec{x} = t\vec{u} - (2t+1)\vec{v} \text{ for some } t \in \mathbb{R}\}$.
3. (a) Find values of x, y that satisfy the following relationships:

$$\begin{aligned} x + y &= 7 \\ 2x - 3y &= 13. \end{aligned}$$

   (b) Find values of x, y, z that satisfy the following relationships (your answer may involve ugly fractions):

$$\begin{aligned} x + 2y + 8z &= 1 \\ 4x + 5y + 8z &= 2. \end{aligned}$$

4. Let $\vec{w} = \begin{bmatrix} 5 \\ -12 \end{bmatrix}$. Find values of a and b so that

$$\vec{w} = a\vec{u} + b\vec{v}.$$

   That is, write $\vec{w}$ as a linear combination of $\vec{u}$ and $\vec{v}$.
5. Let

$$S = \text{span}\left\{ \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}, \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}, \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} \right\}.$$

   Is S a point, line, plane, or all of $\mathbb{R}^3$? Explain.