Let $A = \begin{bmatrix} 2 & 5 & 10 & -6 & 12 \\ 1 & 2 & 5 & -3 & 6 \\ 3 & 10 & 15 & -8 & 14 \\ 1 & 3 & 5 & -2 & 2 \end{bmatrix}$ and $\mathbf{b} = \begin{bmatrix} 11 \\ 7 \\ 7 \\ 2 \end{bmatrix}$; then RREF of $[A|\mathbf{b}]$ is $\left[\begin{array}{ccccc|c} 1 & 0 & 5 & 0 & -6 & 7 \\ 0 & 1 & 0 & 0 & 0 & -3 \\ 0 & 0 & 0 & 1 & -4 & -2 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{array}\right]$.

1A. Use the above information to express all solutions of $A\mathbf{x} = \mathbf{b}$ in the form $\mathbf{p} + \mathbf{v}_h$ where $\mathbf{p}$ is a particular solution of $A\mathbf{x} = \mathbf{b}$ and $\mathbf{v}_h$ represents all solutions of the corresponding homogeneous equation.

1B. In terms of the definition of *linearly independent*, do the columns of A form a linearly independent set? Explain your answer.

1C. Label the columns of A as $\mathbf{a}_1, \mathbf{a}_2, \ldots, \mathbf{a}_5$. Show explicitly how to express $\mathbf{a}_5$ as a linear combination of the first four columns. Give two different ways to do this, one of which involves a non-zero weight for column $\mathbf{a}_3$, while the other does not use $\mathbf{a}_3$ (ie, its weight is 0).
(Write your answers using the symbols $\mathbf{a}_1, \mathbf{a}_2, \ldots, \mathbf{a}_5$; don't copy over all those columns of numbers).

1D. Explain why column $\mathbf{a}_2$ can *not* be written as linear combination of the other four columns.

1E. Do the columns of A span $\mathbb{R}^4$? Why or why not.