1. Let $A = \begin{bmatrix} 6 & 1 & 0 \\ 12 & 5 & 0 \\ 0 & 0 & 2 \end{bmatrix}$. **1A.** Find the characteristic polynomial of A in factored form. Show all your work.

1B. Use (1A) to list all the eigenvalues of A along with their respective multiplicities:

2. Let $B = \begin{bmatrix} 6 & -4 & 2 \\ 1 & 2 & 1 \\ 1 & -2 & 5 \end{bmatrix}$. It's a **fact** (you don't need to show this) that $\lambda = 4$ is an eigenvalue of B of multiplicity 2.

2A. Find a basis of the eigenspace corresponding to $\lambda = 4$. Show all your work, starting by explicitly finding $B - 4I_3$.

2B. Find $B\mathbf{c}$, where $\mathbf{c} = \begin{bmatrix} 3 \\ 4 \\ 5 \end{bmatrix}$.

2C. Show that $\mathbf{c} = \begin{bmatrix} 3 \\ 4 \\ 5 \end{bmatrix}$ is in the eigenspace of $\lambda = 4$ by writing $\mathbf{c}$ as a linear combination of the basis vector(s) you found in (2A). (Give the LC explicitly).

2D. Compute $B\,\mathbf{k}$ for $\mathbf{k} = \begin{bmatrix} 2 \\ 1 \\ 1 \end{bmatrix}$. What do you discover from this?

2E. Using the discovery in (2D) and the **fact** given at the start of problem **(2)**, find the characteristic polynomial of B in factored form (no need to multiply it all out).