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3. (10 points) Define "eigenvalue". The number λ is an eigenvalue for the matrix A if there exists a vector v, with $v \neq 0$ and $Av = \lambda v$.

4. (10 points) Solve the system of equations which corresponds to the following augmented matrix:

$$\left[\begin{array}{ccc|c} 1 & 2 & 3 & 1 \\ 0 & 1 & 1 & 2 \\ 0 & 0 & 1 & 3 \end{array}\right].$$

$R1 \mapsto R1 - 2R2$ $\left[\begin{array}{ccc|c} 1 & 0 & 1 & -3 \\ 0 & 1 & 1 & 2 \\ 0 & 0 & 1 & 3 \end{array}\right]$

$R2 \mapsto R2 - R3$
$R1 \mapsto R1 - R3$ $\left[\begin{array}{ccc|c} 1 & 0 & 0 & -6 \\ 0 & 1 & 0 & -1 \\ 0 & 0 & 1 & 3 \end{array}\right]$

$\begin{bmatrix} -6 \\ -1 \\ 3 \end{bmatrix}$

5. (10 points) Solve the system of equations which corresponds to the following augmented matrix:

$$\left[\begin{array}{ccccc|c} 1 & 2 & 0 & 4 & 0 & 1 \\ 0 & 0 & 1 & 3 & 0 & 2 \\ 0 & 0 & 0 & 0 & 1 & 3 \end{array}\right].$$

$x_1 = 1 - 2x_2 - 4x_4$
$x_2 = x_2$
$x_3 = 2 - 3x_4$
$x_4 = x_4$
$x_5 = 3$

x_2, x_4 are arbitrary