1. (40 points)
Find $\det(A)$, where

$$A = \begin{bmatrix}
1 & -2 & 4 & 3 \\
2 & 3 & b & c \\
-1 & 2 & -3 & -5 \\
3 & -6 & 15 & 8
\end{bmatrix}$$

2. (40 points)
Use Cramer’s Rule to solve the following system of equations for $x$ and $y$

$$Fx - Qy = P$$
$$Qx + Fy = R$$
3. (40 points)
Does the following matrix, $A$, have an eigenbasis?
If so, what is the eigenbasis?

\[
A = \begin{bmatrix}
1 & 0 & 1 \\
0 & 1 & 0 \\
0 & 0 & 0
\end{bmatrix}
\]

4. (40 points)
Is the following matrix, $A$, diagonalizable?
If so, find an invertible $S$ matrix and diagonal $D$ matrix such that $D = S^{-1}AS$

\[
A = \begin{bmatrix}
1 & 0 & 9 \\
0 & 0 & 0 \\
1 & 0 & 1
\end{bmatrix}
\]

5. (40 points)
Given the matrix

\[
A = \begin{bmatrix}
1 & -1 \\
0 & 0
\end{bmatrix}
\]

Find $A^p$ (where $p$ is a positive integer)