Group members (2 to 4):

(1) For which values of a, b, and c is the determinant of the matrix below equal to zero?

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$$\left(\begin{array}{rrrr}1&a&a\\b&b&b\\c&c&1\end{array}\right)$$

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(2) Matrices A and B shown below each represent a rotation in three dimensional space. Matrix A rotates 45 degrees counterclockwise around the z axis, and matrix B rotates 45 degrees around the x axis.

$$A = \begin{pmatrix} \frac{\sqrt{2}}{2} & -\frac{\sqrt{2}}{2} & 0\\ \frac{\sqrt{2}}{2} & \frac{\sqrt{2}}{2} & 0\\ 0 & 0 & 1 \end{pmatrix}, \quad B = \begin{pmatrix} 1 & 0 & 0\\ 0 & \frac{\sqrt{2}}{2} & -\frac{\sqrt{2}}{2}\\ 0 & \frac{\sqrt{2}}{2} & \frac{\sqrt{2}}{2} \end{pmatrix}$$

The combination of rotating with matrix A followed by B is represented by C = BA. The matrix C can be thought of as representing a single rotation around some axis. (a) Find that axis of rotation by computing the eigenvector of C with eigenvalue 1.

(b) Find a basis for the subspace of vectors perpendicular to the axis from part (a).