

Group members (2 to 4): _____

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

$$\begin{pmatrix} 1 & a & a \\ b & b & b \\ c & c & 1 \end{pmatrix}$$

- (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).