$with(LinearAlgebra):$

$A := Matrix\left(\left[\left[2, 0, \frac{8}{9}\right], \left[0, 2, \frac{-16}{9}\right], [0, 0, 2]\right]\right);$

$$A := \begin{bmatrix} 2 & 0 & \frac{8}{9} \\ 0 & 2 & -\frac{16}{9} \\ 0 & 0 & 2 \end{bmatrix} \quad (1)$$

$B := A^{(-1)};$

$$B := \begin{bmatrix} \frac{1}{2} & 0 & -\frac{2}{9} \\ 0 & \frac{1}{2} & \frac{4}{9} \\ 0 & 0 & \frac{1}{2} \end{bmatrix} \quad (2)$$

$Eigenvalues(A);$

$$\begin{bmatrix} 2 \\ 2 \\ 2 \end{bmatrix} \quad (3)$$

$Eigenvectors(A);$

$$\begin{bmatrix} 2 \\ 2 \\ 2 \end{bmatrix}, \begin{bmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix} \quad (4)$$

Observe that the dimension of the eigenroom is 2!! The axis is the line generated by Y(0: 1: 0) and X(1: 0: 0), i.e the axis is the ideal line z[0: 0: 1].

$Tr := Transpose(B);$
$Eigenvalues(Tr):$
$Eigenvectors(Tr);$

$$Tr := \begin{bmatrix} \frac{1}{2} & 0 & 0 \\ 0 & \frac{1}{2} & 0 \\ -\frac{2}{9} & \frac{4}{9} & \frac{1}{2} \end{bmatrix}$$

$$\left[\begin{array}{c}\frac{1}{2}\\\frac{1}{2}\\\frac{1}{2}\end{array}\right], \left[\begin{array}{ccc}0 & 2 & 0\\0 & 1 & 0\\1 & 0 & 0\end{array}\right] \quad (5)$$

Again the dimension of the eigenroom tfor the eigenvalue 1/2 to Tr is 2. We have a pencil of lines generated by the lines z[0: 0:1] (remember that the axis is invariant as a set) and l[2: 1: 0]. this lines generate the point C(1: -2: 0), the centre of the collination. **As C belongs to z,** the collineation is an elation.

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