

**MTH101 (Symmetry)****Tutorial Sheet 05** / February 08, 2022

Spring 2022

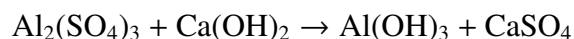
1. Convert the following matrices to a row echelon matrix and determine which of these are invertible.

$$\begin{pmatrix} 1 & 2 & 3 \\ 1 & 4 & 9 \\ 1 & 8 & 27 \end{pmatrix}, \begin{pmatrix} \cos \theta & -\sin \theta & 0 \\ \sin \theta & \cos \theta & 0 \\ 0 & 0 & 1 \end{pmatrix}, \begin{pmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 1 \\ 1 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{pmatrix},$$

$$\begin{pmatrix} \cos 2\theta & \sin 2\theta \\ \sin 2\theta & -\cos 2\theta \end{pmatrix}, \begin{pmatrix} 2 & 0 & -1 & 0 \\ 3 & 0 & 0 & -1 \\ 12 & 2 & -3 & -4 \\ 0 & 1 & 0 & -1 \\ 0 & 2 & -3 & 0 \end{pmatrix}$$

In each case where the matrix is invertible find the inverse.

2. Use one of the matrices in Q1 to balance the following chemical reaction.



3. Write the rotation matrix in Q1 as a product of elementary matrices.
 4. Solve the following systems of linear equations.

$$\begin{aligned} \text{(a)} \quad & 8x + y + 6z = 20 \\ & 3x + 5y + 7z = 40 \\ & 4x + 9y + 2z = 60 \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad & 2x + 3y - z = 2 \\ & x - y + z = 5 \\ & x + 9y - 5z = 10 \end{aligned}$$