1) Given that, $A = \begin{bmatrix} 1 & 2 & -1 \\ 3 & 0 & 5 \end{bmatrix}$, $B = \begin{bmatrix} 2 & -1 & 1 \\ 2 & 1 & 0 \end{bmatrix}$, $C = \begin{bmatrix} 3 & 1 \\ 1 & 3 \end{bmatrix}$ and $D = \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$, find, where possible:

(i) $A+B$ (ii) $A+C$ (iii) $C+D$ (iv) CA
(v) AB (vi) AC (vii) $A'C'$ (viii) C^{-1}

2) Find the set of all 2x2 matrices X such that $X^2 = 0$. Give one example.

3) Use elementary row operations to find the inverse of the matrix $\begin{pmatrix} 1 & -1 & 1 \\ 1 & 1 & 2 \\ 2 & -1 & 2 \end{pmatrix}$ and hence solve the equations:

(i) $x - y + z = 1$
(ii) $x + y + 2z = 0$
(iii) $2x - y + 3z = 2$

4) If $A = \begin{pmatrix} 2 & -1 \\ -1 & 2 \end{pmatrix}$ and $B = \begin{pmatrix} 1 & 0 \\ 0 & 3 \end{pmatrix}$, show that the most general 2x2 matrix X such that $AX = XB$ is of the form $\begin{pmatrix} x & y \\ x & -y \end{pmatrix}$. Hence, find a 2x2 matrix P such that $P^{-1}AP = B$ and $P'P = I$, where I is the unit 2x2 matrix.

5) What transformations are represented by the following matrices? Illustrate each transformation by means of an example.

(i) $\begin{pmatrix} 2 & 0 \\ 0 & 3 \end{pmatrix}$ (ii) $\begin{pmatrix} -3 & 0 \\ 0 & -3 \end{pmatrix}$ (iii) $\begin{pmatrix} -\frac{1}{\sqrt{2}} & \frac{\sqrt{3}}{2} \\ \frac{\sqrt{3}}{2} & \frac{1}{2} \end{pmatrix}$ (iv) $\begin{pmatrix} 0 & -2 \\ -2 & 0 \end{pmatrix}$ (v) $\begin{pmatrix} -\sin\alpha & -\cos\alpha \\ \cos\alpha & \sin\alpha \end{pmatrix}$

6) Solve for x:

$$\begin{vmatrix} 2-x & -3 & 5 \\ 0 & 5-x & 2 \\ 8 & -6 & 8-x \end{vmatrix} = 0$$