1. Consider the points $\bar{x}_1 = \begin{pmatrix} 1 \\ 1 \\ 1 \\ 1 \end{pmatrix}$, $\bar{x}_2 = \begin{pmatrix} 2 \\ 1 \\ 3 \\ 2 \end{pmatrix}$, $\bar{x}_3 = \begin{pmatrix} 1 \\ 2 \\ 3 \\ 1 \end{pmatrix}$.
   (a) Fid a parametric equation of the plane in $R^4$ passing passing through these points. Verify that it does indeed pass through the above points.
   (b) Find the equation of the plane parallel to the above plane passing through the origin.

2. Determine between which $R^n$ the following transformations act. Determine whether they are linear or not. For those that are linear find their matrix representation. Show all work.
   (a) $f(x, y, z) = \begin{pmatrix} 2x + 2y \\ zy \end{pmatrix}$.
   (b) $f(x, y) = \begin{pmatrix} 2y \\ 5y \end{pmatrix}$.
   (c) The transformation below $f$ is linear. Furthermore $f(1, 2) = \begin{pmatrix} 2 \\ 3 \\ 2 \end{pmatrix}$ $f(1, 1) = \begin{pmatrix} 1 \\ 2 \\ 0 \end{pmatrix}$. Find the matrix representation for $f$.

3. Determine whether the vectors below are linearly independent. For those that are not find the largest linearly independent set.
   (a)
$$\bar{v}_1 = \begin{pmatrix} 1 \\ 2 \\ 1 \end{pmatrix}, \quad \bar{v}_2 = \begin{pmatrix} 2 \\ 1 \\ 3 \end{pmatrix} \quad \bar{v}_3 = \begin{pmatrix} 1 \\ -4 \\ 3 \end{pmatrix}$$
   (b)
$$\bar{v}_1 = \begin{pmatrix} 0 \\ 1 \\ 2 \\ 1 \end{pmatrix}, \quad \bar{v}_2 = \begin{pmatrix} 2 \\ 1 \\ 3 \\ 0 \end{pmatrix} \quad \bar{v}_3 = \begin{pmatrix} 2 \\ 2 \\ 5 \\ 1 \end{pmatrix}$$

4. Let
$$A = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}, \qquad B = \begin{pmatrix} 1 & 0 & 2 \\ 2 & 1 & 3 \end{pmatrix}, \text{ and } C = \begin{pmatrix} 2 & 2 \\ 1 & 4 \end{pmatrix}$$
.
   a. Determine between what $R^n$ do the above matrices act.
   b. Find $AB$,
   c. Find $A + C$,
   d. Find $B^T$.