1) Consider the vectors $u = (1,4,-8)$, $v = (-2,2,1)$ and $w = (2,1,8)$.
   a) Determine the cosine of the angle between u and v and decide whether it is acute, obtuse or they are orthogonal.
   b) Find the vector component of u along w and the vector component of u orthogonal to w.
   c) Find a vector orthogonal to both u and v and then find the area of the parallelogram determined by the vectors u and v.
   d) Find the norm of $u + 2v$.
   e) Find the volume of the parallelepiped in the 3-space determined by the vectors u, v and w.

2) a) Find the equation of the plane passing through the point $P(1,2,-3)$ and parallel to the plane whose equation is $3x - 2y - z + 10 = 0$.

b) Show that the planes $x + 2y + 3z - 2 = 0$ and $2x + 4y + 6z - 1 = 0$ are parallel and find the distance between them.

c) Find parametric equations for the line passing through $P(-3,-1,2)$ and which is parallel to the vector $n = (2,-1,3)$.

d) Find the equation of the plane passing through the points $(1,2,1)$, $(2,-1,3)$ and $(-1,3,4)$.

3) Consider the linear operators $T: R^2 \rightarrow R^2$ and $S: R^2 \rightarrow R^2$ where T has the standard matrix representation $[T] = \begin{bmatrix} 2 & 2 \\ 4 & -2 \end{bmatrix}$ and S is the rotational operator counterclockwise by an angle $\frac{\pi}{4}$.

   a) Is the operator T one to one ? Onto? Why?
   b) Find the vector $v = (ToS)(u)$, where $u = (\frac{\sqrt{2}}{2}, 0)$.
   c) Find $T(-2,2)$ and $S(-1,1)$.
   d) Find $(SoT)^{-1}(w)$ if exists, where $w = (1,1)$.