1)a) Evaluate the iterated integral: (i) $\int_{-2}^{2}\int_{0}^{\sqrt{4-x^2}} \cos(x^2+y^2)\,dydx$. (ii) $\int_0^1\int_{\sqrt{y}}^{1} \frac{1}{x^3+1}dxdy$.

b) Find the area of the surface part of the sphere $x^2+y^2+z^2=1$ that lies inside within the cylinder $x^2+y^2=x$ and above the $xy-plane$. (sketch the cylinder).

2)a) Find a basis for the subspace $W=\{(x,y,z): 3x-2y+5z=0\}$ of R^3.

b) Find the distance between the vectors $u=(2,1,-1)$ and the vector $v=(2,1,1)\times(-1,2,4)$.

3)a) Determine whether the following set $S=\{p_1=1-x+2x^2,\ p_2=3+x, p_3=5-x+4x^2,\ p_4=-2-2x+2x^2\}$ spans the vector space P_2 of all polynomials with degree less than or 2. What is the dimension of the vector subspace $W=span(S)$?

b) For which real values of μ do the following vectors form a linearly dependent set in R^3?

$$u_1=\left(\mu,-\frac{1}{2},-\frac{1}{2}\right), u_2=\left(-\frac{1}{2},\mu,-\frac{1}{2}\right), u_3=(-\frac{1}{2},-\frac{1}{2},\mu)$$

4) a) Use the Garm-Schmidt process to transform the basis $S=\{v_1=(1,1,1), v_2=(-1,1,0), v_3=(1,2,1)\}$ of the 3-space into an orthonormal basis T.

b) If $w=(1,2,3)$ find the coordinate vector of w with respect to the basis S ($(w)_S$ =?).

c) If $w=(1,2,3)$ find the coordinate vector of w with respect to the orthonormal basis T ($(w)_T$ =?).

5) Consider the matrix $A=\begin{bmatrix}4&0&1\\2&3&2\\1&0&4\end{bmatrix}$ with its characteristic polynomial $p(\mu)=-(\mu-5)(\mu-3)^2$.

a) For each eigenvalue μ of A, find the set of eigenvectors corresponding to μ.

b) If possible, find a basis for R^3 consisting of eigenvectors of A. Is A diagonalizable?

c) If successful in b), find an invertible matrix P and a diagonal matrix D such that $P^{-1}AP=D$.

d) Find the eigenvalues of A^2 and $(A-3I)$ and their corresponding eigenvectors.