

1) Evaluate the following integrals:

a) $\iint_D xy dA$, where D is enclosed by the curves $y = x^2$ and $y = 3x$.

b) $\int_{-2}^2 \int_0^{\sqrt{4-x^2}} \sin(x^2 + y^2) dy dx$.

2) Consider the set $S = \{u_1, u_2, u_3\}$ of vectors in R^3 , where $u_1 = (1,0,1)$, $u_2 = (0,1,2)$ and $u_3 = (2,1,0)$.

a) Show that S is a basis for R^3 .

b) Use the Gram-Schmidt process to construct an orthonormal basis from the basis S .

c) Find the coordinate vector for the vector $v = (1,2,-1)$ with respect to the constructed orthonormal basis in b.

d) Find the QR – *decomposition* of the matrix $B = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 1 & 1 \\ 1 & 2 & 0 \end{bmatrix}$.

3) Consider the matrix $A = \begin{bmatrix} -1 & 4 & -2 \\ -3 & 4 & 0 \\ -3 & 1 & 3 \end{bmatrix}$.

a) Find the eigenvalues and corresponding eigenvectors for the matrix A .

b) Show that A is diagonalizable and find a matrix P that diagonalizes A , then determine $P^{-1}AP$.

c) Compute A^{10} .

d) Find the eigenvalues of the matrices A^{-1} , $A - 3I$ and A^2 .