

University of Texas at San Antonio

Engineering Analysis II, MAT 3263

Exam $\mathcal{N}^{\circ}1$, 10/17/91

Instructor: D. Gokhman

Name: _____

1. (20 pts.)
 - (a) Find a basis for the vector space $\{x \vec{i} + y \vec{j} + z \vec{k} \in \mathbf{R}^3: x + 2y + 5z = 0\}$,
 - (b) Calculate the projection of the vector $(5, 4, 2) \in \mathbf{R}$ in the direction given by $(1, -1, 0)$. (Note: The answer should be a vector)
2. (25 pts.) Let $\vec{F} = (x^2 - 2xy) \vec{i} + (y^2 - 2xy) \vec{j}$. Calculate the curve integral of \vec{F} along the parabola $y = x^2$ from $(-1, 1)$ to $(1, 1)$. Draw the curve first.
3. (25 pts.) Let $\vec{F} = x \vec{i} + y \vec{j}$. Calculate the surface integral of \vec{F} over the surface determined by $x^2 + y^2 + z^2 = 1, z \geq 0$. Draw the surface first.
4. (30 pts.) Let $\vec{F} = x^5 \vec{i} + y^5 \vec{j} + z^5 \vec{k}$. Let \mathcal{C} be a curve given in cylindrical coordinates (ρ, θ, z) by $\rho = \sin \theta, 0 \leq \theta \leq \pi, z = \pi\theta - \theta^2$
 - (a) Calculate the Jacobian matrix of \vec{F} . What is the trace (sum of the diagonal entries) of the Jacobian matrix? What is it equal to in this case?
 - (b) Calculate $\nabla \times \vec{F}$.
 - (c) Draw the curve \mathcal{C} . What is the line integral of \vec{F} along this curve?