

Analysis III for Engineering Students Work Sheet 2

Exercise 1:

Given a vector field

$$\mathbf{g}(x, y) = (u(x, y), v(x, y))^T = (1, 3x^2)^T$$

- a) compute $\operatorname{div} \mathbf{g}$ and $\operatorname{curl} \mathbf{g}$ and
- b) make a sketch of the vector field and some streamlines in the area $[-1, 1] \times [-1, 1]$.

Exercise 2:

Compute the Jacobian matrices of the following functions using the definition

- a) $f(x, y, z) = \sqrt{z} \sin(x + y) + e^{y+z}$ and $x, y \in \mathbb{R}$, $z \in \mathbb{R}^+$,
- b) $\mathbf{g}(t) = (\cos t, \sin t)^T$ and $t \in \mathbb{R}$,
- c) $\mathbf{h}(x, y) = (x + y^2, 3x^2 + 4y)^T$ and $x, y \in \mathbb{R}$,
- d) $\mathbf{u}(t, x, y, z) = (x - e^{y-t}, 3z - xt^2, t + 5x + y^2 + 4z)^T$ and $t, x, y, z \in \mathbb{R}$.

Discussion: 6.11. - 10.11.23