Math 495R Homework 18

In this lab you will create visualizations to help you understand vector fields. Before beginning the lab, please review how to create quiver plots in python.

https://problemsolvingwithpython.com/06-Plotting-with-Matplotlib/06.15-Quiver-and-Stream-Plots/

A quiver plot is a plot that shows vectors as arrows and is especially useful when talking about vector fields.

(1) Plot the vector field $\mathbf{F}(x, y) = (y^2 - 2xy)\mathbf{i} + (3xy - 6x^2)\mathbf{j}$.
(2) Let $\mathbf{F}(\mathbf{x}) = (r^2 - 2r)\mathbf{x}$, where $\mathbf{x} = \langle x, y \rangle$ and $r = |\mathbf{x}|$. You may have to vary your domain to see what is happening.
(3) Plot the gradient vector field of f together with a contour map of f for:
    (a) $f(x, y) = \ln(1 + x^2 + 2y^2)$
    (b) $f(x, y) = \cos x - 2 \sin y$
(4) Of course there are also vector fields in higher dimensions. Plot the following vector fields:
    (a) $\mathbf{F}(x, y, z) = \mathbf{i} + 2\mathbf{j} + 3\mathbf{k}$
    (b) $\mathbf{F}(x, y, z) = \mathbf{i} + 2\mathbf{j} + z\mathbf{k}$
    (c) $\mathbf{F}(x, y, z) = x\mathbf{i} + y\mathbf{j} + z\mathbf{k}$
    (d) $\mathbf{F}(x, y, z) = \sin y\mathbf{i} + (x \cos y + \cos z)\mathbf{j} - y \sin z\mathbf{k}$