MS-A0211 - Differential and integral calculus 2, period III, 2020 David Radnell

Assignment 5: Due: 11.02.2020

AE = Adams and Essex (see course materials).

1. AE, 12.6, page 722. Exercises 17, 18. In both these exercises also compute the determinant of the Jacobian. This will be needed when we do double and triple integrals in these coordinate systems.

2. Let $f(x, y) = \ln(x^2 + y^3)$. Find the second order Taylor polynomial of f centered at $(1, 0)$. Also, plot the graphs of the function and the quadratic Taylor polynomial you just found on the same axes to show that the approximation you calculated is indeed approximating the function well near the given point.

3. AE 13.7, page 802. Exercise 2. Be sure to sketch the surfaces/graphs as suggested. Matlab, Mathematica, Maple, Excel, or Google Sheets are all easy places to implement Newton's method.

   Feel free to use the Jacobian language in the Newton's method question. The formula derived in class was

   $$\mathbf{x}_{i+1} = \mathbf{x}_i - J_{\mathbf{F}}^{-1}(\mathbf{x}_i)F(\mathbf{x}_{i+1})$$

   where $\mathbf{F} = [f_1, \ldots, f_n]^T$ and $\mathbf{x} = [x_1, \ldots, x_n]^T$ are column vectors (T denotes transpose) and $J_{\mathbf{F}}$ is the $n \times n$ Jacobian matrix of $\mathbf{F}$.

4. Guichard, Section 15.1, Exercises, 1, 3, 10, and 20.

5. Guichard, Section 15.2, Exercises, 2, 6, 10, and 12.

Suggested problems (not to be submitted)

1. AE, page 750 - 751. End of chapter test. Make sure you do the key ideas section. (Of course not all problems are relevant but most are).

2. Do a selection of problems from the sections of the books referred to in the "lecture blog".