BRAC UNIVERSITY

Inspiring Excellence

Department of Mathematics and Natural Sciences

MAT 110

ASSIGNMENT 4

SUMMER 2021

SET: 7 (MJM)

Please write your name and ID on the first page of the assignment answer script - you have to do this for both handwritten or LaTeX submission. The last date of submission is 25/8/2021, 1159 pm. Solve all problems.

You can only submit a PDF file - image or doc files won't be accepted. Before submitting the PDF, please rename the PDF file in the format - SET_ID_SECTION.

Answer the questions by yourself. Plagiarism will lead to an F grade in the course. ***Total marks is 300. Each question is worth 50 marks.*** *If you do your work using LaTeX you will get a mark which will be added as a LaTeXbonus to your course grade.*

If you use LaTeX, you must add a screenshot of the raw code and compiled pdf side by side, in order to earn your bonus.

This set was prepared by MJM. If you have any questions, please text MJM on Slack.

1. Determine the first and second degree Maclaurin polynomial approximations, $L(x, y)$ and $Q(x, y)$, for the following function:

$$f(x, y) = ye^{xy+3x+2y^2}$$

2. Find and classify all the extrema of the function

$$f(x, y) = 4xye^{-x^2-y^2}$$

3. Find the point in the plane $x - 2y + z = 16$ that is closest to the origin.

4. Compute $div\vec{F}$ and $curl\vec{F}$ for $\vec{F} = -x^2(y-z)\hat{i} - (x^2+y^4)\hat{j} + (\frac{4z^2}{y^2})\hat{k}$.

5. If $\vec{F} = 2yz\hat{i} - x^2y\hat{j} + xz^2\hat{k}$ and $\phi = 2x^2yz^3$, find $\vec{F} \cdot (\nabla\phi)$

6. Find the directional derivative of the function

$$f(x, y, z) = x^2y + y^2z + xz^2$$

at the point $(2, 4, 5)$ in the direction of the point $(1, -1, 3)$. Give your answer correct to 2 decimal places.