BRAC UNIVERSITY

Inspiring Excellence

Department of Mathematics and Natural Sciences

MAT 110

# ASSIGNMENT 4

SUMMER 2021

## SET: 6 (MJM)

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*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 Taylor polynomial approximations, $L(x, y)$ and $Q(x, y)$, for the following function near the point $(1, 0)$:

$$f(x, y) = -3e^{x^3+x^2y+y^3}$$

2. Find and classify all the extrema of the function

$$h(x, y) = xye^{-\frac{1}{2}(x^2+y^2)}$$

3. Find the point in the plane $2x - y + 4z = 16$ that is closest to the origin.

4. Compute $div\vec{E}$ and $curl\vec{E}$ for $\vec{E} = -(4z^2 - 3)\hat{i} - (xyz^2)\hat{j} + (5 - 2yz)\hat{k}$.

5. Given, $\phi = 3x^2z - z^2y^3 + 4y^3x^2 - 2y + 4z - 1$. Find $\nabla^2\phi$.

6. Find the directional derivative of the function

$$f(x, y, z) = 2xy^3 - 2xz^2 + 5xyz$$

in the direction of the vector $\vec{v} = -2\hat{i} + 6\hat{j} + 3\hat{k}$. Evaluate this directional derivative at the point $(-3, -1, 2)$. Give your answer correct to 2 decimal places.