COMP2208
Math problem sheet 4

1 OVERVIEW

The key points of this problem-sheet are:

- This problem-sheet counts for 5% of this module.
- The questions in this problem-sheet are in multiple-choice format. For each question, select the solution from the choices given.
- The deadline[1] for submission of your solutions: **4^{th} Dec. 2020 by 4pm.**
- Summative feedback will be given within 2 weeks after the deadline.
- Learning Outcome: Test your knowledge on partial derivatives, total derivatives and gradients.

For submission instructions, please see Section 3 at the end of this document.

2 PROBLEMS

QUESTION 1 (1 point). Find the partial derivative of the following function:

$$f(x,y) = \sin(xy)$$

a $(y\cos(xy), x\cos(xy))$

[1] Solutions submitted after the deadline will not be accepted.

b $(x\sin(xy), y\sin(xy))$

c $\left(\frac{y}{\cos(xy)}, \frac{x}{\cos(xy)}\right)$

d $\left(\frac{x}{\cos(xy)}, \frac{y}{\cos(xy)}\right)$

QUESTION 2 (1 point). Find ∇f of the following function:

$$f(x, y, z) = xy + xe^{-xz}$$

a $(y + e^{-xz} - xe^{-xz}, y, -xe^{-xz})$

b $(y + e^{-xz} - ze^{-xz}, x, -e^{-xz})$

c $(y + e^{-xz} - xz, x, -x^2e^{-xz})$

d $(y + e^{-xz} - xze^{-xz}, x, -x^2e^{-xz})$

QUESTION 3 (1 point). Calculate the total derivative of the following function:

$$f(x, y, z) = (z\sin x, y\sin x, z^2)$$

a $\begin{pmatrix} \cos x & 0 & \sin x \\ y\cos x & \sin x & 0 \\ 0 & 0 & 2z \end{pmatrix}$

b $\begin{pmatrix} z\cos x & 0 & \sin x \\ y\cos x & \cos x & 0 \\ 0 & 0 & 2z \end{pmatrix}$

c $\begin{pmatrix} z\cos x & 0 & \sin x \\ y\cos x & \sin x & 0 \\ 0 & 0 & 2z \end{pmatrix}$

d $\begin{pmatrix} z\cos x & 0 & \sin x \\ \cos x & \sin x & 0 \\ 0 & 0 & 2z \end{pmatrix}$

QUESTION 4 (1 point). Consider the function $f(x,y) = e^{-2x^2-5y^2}$. Find the directional derivative in the direction of vector $(1,2)$ at point $(1,1)$.

a $\left(\frac{-24}{5e^7}, \frac{-48}{5e^7}\right)$

b $\left(\frac{-14}{5e^7}, \frac{-34}{5e^7}\right)$

c $\left(\frac{-14}{5e^5}, \frac{-34}{5e^5}\right)$

d $\left(\frac{-24}{5e^5}, \frac{-48}{5e^5}\right)$

QUESTION 5 (1 point). Consider the function $f(x,y) = \sin(xy)$. Find the directional derivative in the direction of vector $(3,2)$ at point $(\pi/4, \pi/4)$.

a $(0.41, 0.31)$

b $(0.67, 0.64)$

c $(0.74, 0.49)$

d $(0.83, 0.21)$

3 SUBMISSION INSTRUCTIONS

Submit your work using the ECS electronic hand-in system. The submission is to be made by **4pm** on the due date listed above. Please submit a single file to the ECS electronic hand-in system as detailed below:

- Your submission file must be named as **comp2208-ps4.txt**.
- Your submitted file must be in a **plain ASCII text file format**.
- You can use Notepad (Windows operating system users) or vim, emacs etc. (Linux users) to create the file.
- Each line of the submitted text file should only contain the question number, followed by a single space, and the selected solution for that question.
- Example, if a, b, c, d and a are the solutions you have selected for Questions 1, 2, 3, 4 and 5, respectively, your submitted file should have the following:

```
1 a
2 b
3 c
4 d
5 a
```

- So, a problem sheet with five questions will have five lines of text.
- Make sure the questions are answered in ascending order in your text file.
- Failure to follow these instructions will incur a penalty.