School of Mathematics and Statistics

MAST20009 Vector Calculus, Semester 1 2020

Assignment 1 and Cover Sheet

Student Name	*Student Number*
Tutor's Name	*Tutorial Day/Time*

Submit your assignment to your tutor's MAST20009 assignment box before 11am on Tuesday 24th March.

- This assignment is worth 5% of your final MAST20009 mark.
- Assignments must be neatly handwritten in blue or black pen on A4 paper. Diagrams can be drawn in pencil.
- You must complete the plagiarism declaration on the LMS before submitting your assignment.
- Full working must be shown in your solutions.
- Marks will be deducted for incomplete working, insufficient justification of steps, incorrect mathematical notation and for messy presentation of solutions.

1. Consider the function

$$f(x,y) = \begin{cases} \dfrac{xy^6}{3x^4+4y^6}, & (x,y) \neq (0,0) \\ 0, & (x,y) = (0,0). \end{cases}$$

(a) Evaluate

$$\lim_{(x,y)\to(0,0)} f(x,y)$$

along the path $y = kx$, where $k \in \mathbb{R} \setminus \{0\}$.

(b) Evaluate

$$\lim_{(x,y)\to(0,0)} f(x,y)$$

if it exists or justify why the limit does not exist.

(c) Find $\dfrac{\partial f}{\partial x}$ and $\dfrac{\partial f}{\partial y}$ for all $(x,y) \in \mathbb{R}^2$.

(d) Determine where f is C^1. Justify your answer, referring to any theorems you use.

2. Consider the function

$$g(x,y) = (3y-x)^{\frac{3}{2}}.$$

(a) Determine the second order Taylor polynomial for g about $(2,1)$.

(b) Using part (a), approximate $g(2.1, 0.9)$.

(c) Using Taylor's remainder formula, determine an upper bound for the error in your approximation of $g(2.1, 0.9)$.

(d) Calculate the actual error in your approximation of $g(2.1, 0.9)$. How does the actual error compare to your approximate error in part(c)?