Queen Mary University of London

MTH4101 Calculus II, Spring 2013

Problem sheet for Tutorial 1

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- The questions are designed to help you with material covered in Week 1. You will get help with them in the tutorial on 17 or 18 January.
- You should write up your solution to the starred question (*) clearly and hand it in to your personal tutor in your assigned tutorial on 24 or 25 January for feedback. *Remember to put your full name and student number on the top of your solution.* Your marked solution to the feedback question will be returned to you in your tutorial on 31 January or 1 February.
- It is important that you try to do all of the questions.

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1. Find the following limits:

$$(a) \quad \lim_{(x,y)\to(1,1),\, x\neq y} \frac{x^2-2xy+y^2}{x-y}; \quad (b) \quad \lim_{(x,y)\to(2,0),\, 2x-y\neq 4} \frac{\sqrt{2x-y}-2}{2x-y-4}.$$

2. By using polar coordinates, either find the limit of the following functions as $(x,y)\to(0,0)$ or show that the limit does not exist:

$$\text{(a)} \quad f(x,y)=\frac{x^3-xy^2}{x^2+y^2}; \qquad (*)\text{(b)} \quad f(x,y)=\frac{y^2}{x^2+y^2}.$$

3. Find all the first and second partial derivatives of the function

$$f(x,y)=e^y\cos x-e^x\sin y+4x^2y^3-3\ln x\,.$$

[2009 exam question]

4. Consider the function

$$f(x,y)=\frac{y}{x}\,,\ x\neq 0\,.$$

Show by using different paths of approach that the limit of f does not exist as $(x,y)\to(0,0)$. [2012 exam question]