

# Practice Exam Questions: Differentiation up to Jacobian matrix

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## 1 Problems

1. Let  $f : \mathbb{R}^2 \rightarrow \mathbb{R}$  be defined by:

$$f(x, y) = \frac{1}{x^2 + y^2}$$

Show that  $f$  is not differentiable at  $(0,0)$ .

2. Use the theorems of this section to find  $f'$  for the following function:

$$f(x, y) = (\cos(xy), \cos(x\cos y), x^y)$$

3. Prove that

$$D\left(\frac{f}{g}\right)(a) = \frac{g(a)Df(a) - f(a)Dg(a)}{[g(a)]^2}$$