Department of Mathematics
STOCKHOLM UNIVERSITY

Examiner: Paul Vaderlind

Examination in
Mathematics for Economic and Statistical Analysis
Master Program; 7,5 ECTS
October 21, 2009; time: 09:00–14:00

No calculators are allowed. Each solved problem is awarded by up to 10 points. At least 35 points are necessary for the grade E, 42 for D, 49 for C, 56 for B and 63 for A. Note that the problems are not ordered according to the difficulty!

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1. For which x is the series $\sum_{n=0}^{\infty} \left(\frac{x^2+1}{5}\right)^n$ convergent. For which x the sum equals 2?

2. Determine if the given improper integrals exist, and evaluate them if they do:
a) $\int_0^2 \frac{x}{\sqrt{4-x^2}}\,dx$, b) $\int_0^\infty \frac{dt}{\sqrt{t+2009}}$.

3. (Implicit differentiation) Find the equation for the tangent line to the curve defined by $x^3e^y + y^3e^x - x^2y^2 + x + 2y - 2 = 0$ at the point $(1,0)$. (Consider y as a function of x.)

4. The function $f(x) = \frac{ax^2+bx+c}{x-1}$ has a local extreme at the point $(2,3)$. Find a, b and c when $a+b+c=-1$. Is this local extreme a local max- or a local min-point?

5. Solve the equation $\begin{vmatrix} 0 & x & -1 \\ x & -7 & 1 \\ 1 & -3 & -4 \end{vmatrix} = \begin{vmatrix} 1 & 1 & x \\ x & -2 & -1 \\ 1 & x & 2 \end{vmatrix}$.

6. For which points (x,y) is the function $g(x,y) = \frac{1}{\ln(1-x^2-y^2)}$ well defined? Investigate the behavior of the function near the border of this region.

7. Let $f(x,y) = 2x^3 - 2y^3 + 3x^2y + 3y$. Find all stationary points for this function and decide whether they are local max-, min-, or saddle-points.

GOOD LUCK!

The papers will be handed out at 14.00 on Tuesday, November 3, 2009, in the room next to the Coffee Shop, house 5, and after that in room 208, house 6.