Examination in Mathematics for Economic and Statistical Analysis
August 20, 2009
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All calculators, except for the graphic, are allowed. Each solved problem is awarded by up to 10 points. At least 50% of points are necessary for the grade E (Sufficient).
Note that the problems are not ordered according to the difficulty.

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1. Given are two functions, $f(x)=\left(\frac{x-1}{x+1}\right)^2$ and $g(x)=(x+1)^4(x-1)$. Find all x for which $f'(x)\cdot g'(x)=3(1-x)$.

2. Find $\lim_{x\to 0}\frac{x\ln(x+1)-x^2}{2(e^x-1-x)-x^2}$ and $\lim_{x\to\infty}\frac{10000x^7+1000x^5+100x^3+10x+1}{x^8-1000x^6-100x^4-10x^2-1}$.

3. The equation $5xy^2-2e^{x+y}+\ln(3x+y+1)+2=0$ defines y as a function of x, $y=y(x)$. Find $y'(x)+y''(x)$ at point $(x,y)=(0,0)$. (Implicit derivative)

4. Determine all local maximum and minimum for the function $f(x)=1+12x+3x^2-2x^3$. Does the function have a global maximum/minimum?

5. Find all partial derivatives of order 2 for the function $f(x,y)=x^3y^2e^y+\ln(2x-y)$.

6. For which x converges the infinite series $(x-1)+\sqrt{x-1}+1+\frac{1}{\sqrt{x-1}}+\frac{1}{x-1}+...$?

Good luck!