English

Contact during examination: Øyvind Bakke
Telephone: 73 59 81 26, 990 41 673

MA0001 Mathematical methods A
Monday 8 December 2003
9:00–13:00
Permitted aids: Any written and printed material. Calculator.
Grades to be announced: 8 January 2004

The problems for the final examination are in two parts:

1. The problems on the next page.

2. Appendix with a multiple choice questionnaire.

The Appendix is to be submitted with the form filled in together with the answer to part (1). Part (1) and (2) count equally in the evaluation of the final examination.

In addition to the final examination the mid-term examination counts 20% if it is advantageous to the candidate.

In the evaluation of part (1) (next page) each of the six points counts equally.

In part (1) you should demonstrate how you arrive at your answers. Answers based on calculator only will not be accepted.

Problem 1

Let f be the function defined by $f(x) = xe^{-x}$ for all real numbers x.

a) Show that $f'(x) = -(x-1)e^{-x}$, $f''(x) = (x-2)e^{-x}$ and $f'''(x) = -(x-3)e^{-x}$ for all real numbers x. Find zeros, extrema and inflection points of f.

b) Evaluate $\lim_{x \to \infty} f(x)$.

c) Give a rough sketch of the graph of f, where monotonicity, concavity and any horizontal asymptote are indicated.

d) Find the area of the unbounded region to the right of the y-axis between the graph of f and the x-axis.

Problem 2

Again let f be the the function defined by $f(x) = xe^{-x}$ for all real numbers x.

a) Write down the Taylor polynomial of degree 2 about 0 for f. Find an approximate value of $f(1/10)$ based on this.

b) Without using a calculator, show that the error using the approximation from (a) is at most 0.0005.