Norwegian University
of Science and Technology
Department of Mathematical Sciences

English

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

MA0001 Mathematical methods A

Friday 17 December 2004
9:00–13:00
Permitted aids: Any written and printed material. One calculator.
Grades to be announced: 17 January 2004

The final examination consists of 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 (e.g. by including intermediate answers or referral to theory). Answers based on calculator or table look-up only will not be accepted.

In all of the following problems f is the function defined by $f(x) = x - \sin x$ for all x in its domain, which is $[0, 2\pi]$.

Problem 1

a) Find f' and f''. Find all zeros, extrema and inflection points of f.

b) Give a rough sketch of the graph of f, where the points from (a) and monotonicity and concavity are correctly indicated.

Problem 2

Evaluate $\int_0^{2\pi} x f(x)\, dx$.

Problem 3

a) Why does f have an inverse function f^{-1}? What is the domain of f^{-1}?

b) Find the Taylor polynomial of degree 3 about 0 for f. Use it to find an approximate value of $f^{-1}(1/10)$.

Problem 4

A function g that is differentiable on all of its domain is defined such that $y = g(x)$ satisfies $y^2 + y = x - \sin x$ for all x in the domain. Find dy/dx expressed by x and y.