

Universität Karlsruhe (TH)
 Mathematisches Institut II
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Karlsruhe, April 11, 2005

Student No:

Worksheet 1 Advanced Mathematics II for Mechanical Engineering

Problem 1: Compute all derivatives $f^{(n)}$, $n = 0, 1, 2, \dots$ of functions f and determine the Taylor series for f at the evaluation point $x_0 = 0$.

- a) $f(x) = \sin 3x$, $x \in \mathbb{R}$, b) $f(x) = \cosh \frac{x}{2}$, $x \in \mathbb{R}$,
 c) $f(x) = \sqrt{1+x}$, $|x| \leq 1$, d) $f(x) = \ln \frac{1+x}{1-x}$, $|x| < 1$.

Where do these series converge?

Problem 2: Compute the first three summands of the Taylor series of $f(x) = x^{10} - 3x^6 + x^2 + 2$ at the evaluation point $x_0 = 1$. Compute an approximate value for $f(1,03)$ and give an error estimate.

Problem 3: Compute the Taylor polynomial of order 3 of $f(x) = \arcsin x$, $|x| \leq \frac{1}{2}$, at the evaluation point $x_0 = 0$ and give an estimations for the remaining terms,

- a) which is only dependent on x but not on the intermediate point ξ ,
 b) which is neither dependent on x , nor dependent on ξ .

Problem 4: Compute the 13th derivative in $x_0 = 0$, $f^{(13)}(0)$, of the function

$$f(x) = x \cos^2(x^3),$$

which may be represented by a power series.

Problem 5: Show that the given functions F are antiderivatives of the given functions f .

	$F(x)$	$f(x)$
a)	$x \sin x + \cos x$	$x \cos x$
b)	$\ln(x + \sqrt{x^2 + 1})$	$(1 + x^2)^{-1/2}$
c)	$\arctan \frac{x-1}{2}$	$\frac{2}{x^2 - 2x + 5}$
d)	$(x^2 - 2x + 2)e^x$	$x^2 e^x$

Due date: Monday, April 18, 2005, 1pm (in the slots outside room 208.1 of the Math Department)