Klausur: 41050 Mathematical Methods I Sommersemester 2016
Prüfer: apl. Prof. Dr. F. Werner

Working time: 60 minutes

The derivation of the results must be given clearly. The statement of the result only is not sufficient.

Tools:

- pocket calculator (according to the instructions of FWW)
- **either** one individually prepared one-sided A4 sheet of paper with arbitrary material (write '1' on cover sheet) **or** textbook 'Mathematics of Economics and Business (write 'B' on cover sheet)

It is not allowed to use mobile phones.

Problems:

1. (a) Check whether the sequence
$$\{a_n\} = \left\{\frac{n^2}{2^n}\right\}$$
is monotone.

   (b) Determine all real solutions of the inequality
$$\frac{x-2}{x+3} < 2x\,.$$
   (12 points)

2. (a) Determine
$$\lim_{x\to\pi+0} \frac{\sin 2x}{\sqrt{3(x-\pi)}}\,.$$
   (b) Given is the function $f : D_f \to \mathbb{R}$ with
$$f(x) = \frac{2x^4 - x^2 - 1}{(x^2 - x)(x+3)}$$
   Specify the discontinuities of function f. Write function f as the sum of a polynomial and a proper rational function. Determine
$$\lim_{x\to\infty} f(x)\,.$$
   (12 points)

3. Given is the function $f : \mathbb{R} \to \mathbb{R}$ with
$$f(x) = 3 \cdot (e^{-x} - e^{-4x})\,.$$
   Determine all zeroes, all local extreme points (and their type) as well as all inflection points of function f.
   (15 points)

4. (a) Using integration by parts, evaluate

$$\int_0^{\frac{\pi}{3}} \frac{\sin^3 x}{\cos^2 x}\, dx\,.$$

(b) Find the integral

$$\int (x+1)^2 e^{3x}\, dx\,.$$

(11 points)