



**Preparatory Course for  
Mathematical Methods in Economics and Business**

**1. Exercise Sheet**

**Exercise 1 (Set Theory)**

The following sets are given  $A = \{1; 2; 3; 4\}$ ,  $B = \{x \mid x \in \mathbb{N} \wedge x > 5\}$  and  $C = \{3; 4; 5; 6\}$ .  
Determine:

- (a)  $A \cap B$ ,
- (b)  $C \setminus A$ ,
- (c)  $B \cup C$ ,
- (d)  $\overline{B}$  with respect to  $\Omega = \mathbb{N}$ ,
- (e)  $(A \cup B) \cap C$ .

**Exercise 2 (Set Theory)**

Let the sets  $A$  and  $B$  be disjoint. Determine:

- (a)  $A \setminus B$
- (b)  $\overline{A} \cap B$
- (c) Set  $D$ , which is a subset of both  $A$  and  $B$ .

### **Exercise 3 (Set Theory)**

Let the universal set  $\Omega$  be the set of all students of a university. Further, let  $F$  be the set of all female students,  $M$  the set of all math students,  $C$  the set of all students in the university's choir,  $B$  the set of all biology students, and  $T$  the set of all tennis players.

Write in set notation:

- (a) There are female biology students active in the university's choir.
- (b) None of the tennis players studies biology.
- (c) The female students that neither play tennis nor belong to the university's choir all study biology.

### **Exercise 4 (Percentage Calculations)**

The stock price of a company drops by 10% in the year 2011 and rises in the years 2012 and 2013 by 5% each. Where is the price at the end of 2013 compared to the start of 2011?

### **Exercise 5 (Interest Calculation)**

Your bank offers you the following terms for your investment (including compound interest): fixed interest rate of 2.065%; maturity: 25 years.

- (a) How much money do you have to invest today to receive 1000 euros at the maturity date?
- (b) How long would you have to invest your money until it tripled?

### **Exercise 6 (Powers and Roots)**

Calculate and simplify as far as possible:

(a)  $\frac{7^3 \cdot 7^2}{7^4}$

(b)  $\left(\frac{-2}{5}\right) \left(\frac{-2}{5}\right) \left(\frac{-2}{5}\right)$

(c)  $\frac{2^{19} - 2^{17}}{2^{19} + 2^{17}}$

**Exercise 7 (Powers and Roots)**

(a) When  $2x^2y = 5$ , then  $4x^4y^2 = ?$

(b)  $\sqrt{13^2 - 12^2}$

(c) Transform the following fraction such that there is no longer a root in the denominator:

$$\frac{\sqrt{3} + \sqrt{2}}{\sqrt{3} - \sqrt{2}}$$

**Exercise 8 (Algebraic Expressions)**

Multiply out the following expressions and simplify as far as possible:

(a)  $(2x - 3y)^2$

(b)  $5a - (3a + 2b) - 2(a - 3b)$

**Exercise 9 (Factorization)**

Factor out the following expressions:

(a)  $9 - z^2$

(b)  $p^3q - 4p^2q^2 + 4pq^3$

**Exercise 10 (Fractions: Basics)**

Simplify the following expressions into a single fraction:

(a)  $\frac{1}{2} - \frac{1}{3}$

(b)  $\frac{6a}{5} - \frac{a}{10} + \frac{3a}{20}$

**Exercise 11 (Fractured Powers and Roots)**

Calculate and simplify the following expressions:

(a)  $(x^{1/2}y^{-1/4})^4$

(b)  $\sqrt[3]{27a^6}$

(c)  $p^{1/5}(p^{4/5} - p^{-1/5})$