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Chair of Econometrics, Statistics and Empirical Economics

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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 disjunct. 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 Ω 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) $\dfrac{7^3 \cdot 7^2}{7^4}$

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

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

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