# Midterm test A

- The time limit is 50 minutes
- Do not forget to clearly write the answer to every question.
- All your computations and derivations should be clear or properly explained

**1.** *(5 b.)* Consider the following formula of predicate logic. Construct its negation and reformulate it in such a way that the sign $\neg$ appears only in front of the "atomic" formulas only.

$$\Big(\forall x\,\forall y\,(Q(x,y) \Rightarrow P(x))\Big) \wedge \Big(R(a) \Rightarrow (\forall x\,(P(x) \Rightarrow R(x)))\Big)$$

**2.** *(5 b.)* An operation $\bullet$ on $\mathbb{R}$ is given by

$$x \bullet y = \sqrt[3]{x^3 + y^3}.$$

Decide, whether $(\mathbb{R}, \bullet)$ forms a group.

**3.** *(5 b.)* Decide, whether $[129]$ is invertible in $(\mathbb{Z}_{301}, \cdot)$.

**4.** *(5 b.)* Find all $x \in \mathbb{Z}$ that satisfy $7^{50} \equiv 33x + 1 \pmod{45}$

# Midterm test B

- The time limit is 50 minutes
- Do not forget to clearly write the answer to every question.
- All your computations and derivations should be clear or properly explained

**1.** *(5 b.)* Consider the following formula of predicate logic. Construct its negation and reformulate it in such a way that the sign $\neg$ appears only in front of the "atomic" formulas only.

$$\Big(\exists x\,\exists y\,(Q(x,y) \Rightarrow P(x))\Big) \vee \Big(R(a) \Rightarrow (\forall x\,(P(x) \Rightarrow R(x)))\Big)$$

**2.** *(5 b.)* An operation $\bullet$ on $\mathbb{R}$ is given by

$$x \bullet y = \sqrt[5]{x^5 + y^5}.$$

Decide, whether $(\mathbb{R}, \bullet)$ forms a group.

**3.** *(5 b.)* Decide, whether $[91]$ is invertible in $(\mathbb{Z}_{299}, \cdot)$.

**4.** *(5 b.)* Find all $x \in \mathbb{Z}$ that satisfy $7^{42} \equiv 18x + 3 \pmod{44}$