

MATH 4140/5140. HOMEWORK 1
Due Wednesday, January 19

Note: All numbered exercises are from Erdmann–Holm ([EH]).

- (1) Read Sections 1.1 and 1.2 of [EH].
- (2) Let G, H be groups and let $\varphi : G \rightarrow H$ be a map such that $\varphi(gg') = \varphi(g)\varphi(g')$ for all $g, g' \in G$. Prove that $\varphi(1_G) = 1_H$.
- (3) Let R be a ring. Prove that $0 \cdot r = 0 = r \cdot 0$ for all $r \in R$.
- (4) Prove that for a positive integer n , the set $M_n(\mathbb{R})$ forms a commutative ring under the usual addition and matrix multiplication if and only if $n = 1$.
- (5) Recall the statements of the first two isomorphism theorems for groups, then use the first isomorphism theorem to prove the second.