(1) Justify each step in the proof of $Lemma 8.11$.

(2) Let G be a group and $a, b, c \in G$.Suppose $ab = ba$.Prove that $(a^m b^n c^r)^{-1} = c^{-r} a^{-m} b^{-n}$ for all $m, n, r \in \mathbb{Z}$, justifying each detail.

(3) Let G be a nonemty set with an associative multiplication on it and let $a_1, a_2, ..., a_n$ be pairwise commuting elements of G. Show that

$$(a_1 a_2 ... a_n)^m = a_1^m a_2^m ... a_n^m$$

for all m $\in \mathbb{N}$

(4) Show that, if G is an additive commutative group, then

$$-(a_1 + a_2 + ... + a_n) = (-a_1) + (-a_2) + ... + (-a_n)$$

for all $a_1, a_2, ... a_n$ in G