Math-113, Homework 1, non-textbook problems

A. We have defined addition and multiplication of complex numbers as explicit operations on coordinates of the corresponding vectors on the plane. Prove the following statements for all $z_1, z_2, z_3 \in \mathbb{C}$ by direct computation in coordinates.

- $(0 + \mathrm{i} \cdot 1) \times (0 + \mathrm{i} \cdot 1) = -1 + \mathrm{i} \cdot 0$
- $z_1 \times z_2 = z_2 \times z_1$ (commutativity)
- $(z_1 \times z_2) \times z_3 = z_1 \times (z_2 \times z_3)$ (associativity)
- $(z_1 + z_2) \times z_3 = z_1 \times z_3 + z_2 \times z_3$ (distributivity)