

HW 1

Due: 21 January 2026

As always, your answer will be graded on the quality of presentation as well as the correct answer. To get a good score: write your answer neatly, use complete sentences, and *justify your work*.

1. Since \mathbb{C} is commutative, it is
 - (a) an (\mathbb{R}, \mathbb{R}) bimodule, using restriction of scalars twice and
 - (b) an (\mathbb{C}, \mathbb{C}) bimodule, using restriction of scalars once.

By (a), we can construct the \mathbb{R} -module $\mathbb{C} \otimes_{\mathbb{R}} \mathbb{C}$, and by (b) we can construct the \mathbb{C} -module $\mathbb{C} \otimes_{\mathbb{C}} \mathbb{C}$. However, using restriction of scalars, we can consider $\mathbb{C} \otimes_{\mathbb{C}} \mathbb{C}$ as an \mathbb{R} -module. Show that the \mathbb{R} -module $\mathbb{C} \otimes_{\mathbb{R}} \mathbb{C}$ the \mathbb{R} -module $\mathbb{C} \otimes_{\mathbb{C}} \mathbb{C}$ are not isomorphic.

2. [Ash10, Exercise 8.7.2]
3. [Ash10, Exercise 8.7.7]

References

[Ash10] Robert B. Ash, *Abstract Algebra: The Basic Graduate Year*, 2010.