Math 503: Homework 1

Note: I had trouble finding past files from UPenn classes since I used TeXWorks back then, not Overleaf. However, I did find a couple tidbits on an Overleaf account that I forgot I had. So I'm including what I found.

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1. (a) It suffices to show that R_n has a structure as an $(F, \mathrm{M}_n(F))$-bimodule since that would imply that $R_n \otimes_{\mathrm{M}_n(F)} C_n$ has a left F-module structure, i.e. a structure as an F-vector space. In fact, this is fairly apparent since R_n is first and foremost an abelian group under component-wise addition. It also two other operations, namely scalar multiplication by elements of F and multiplication on the right by elements of $\mathrm{M}_n(F)$, making R_n into an $(F, \mathrm{M}_n(F))$-bimodule as desired.

   (b)

$$\begin{array}{ccc} R_n \times C_n & \longrightarrow & R_n \otimes_{\mathrm{M}_n(F)} C_n \\ \downarrow & \swarrow & \\ F & & \end{array}$$