

Let $D = \{z \in \mathbb{C} : 0 < |z| < 1, \text{Arg}(z) \in (-\frac{\pi}{4}, \frac{\pi}{4})\}$.

- (a) Provide a sequence of functions $f_n : D \rightarrow \mathbb{C}$ that converges **uniformly** to some function $f : D \rightarrow \mathbb{C}$ on D . *Justify your answer.*
- (b) Provide a sequence of functions $f_n : D \rightarrow \mathbb{C}$ that converges **pointwise but not uniformly** to some function $f : D \rightarrow \mathbb{C}$ on D . *Justify your answer.*
- (c) Provide a sequence of functions $f_n : D \rightarrow \mathbb{C}$ that converges **locally uniformly** to some function $f : D \rightarrow \mathbb{C}$ on D but **does not** converge uniformly to f on D . *Justify your answer.*

In the above, please avoid using examples you've seen in class or in your assignments.