1. Let $A = \mathbf{C}[x, y]$ and let $B = A/(x, y)$. Compute $\operatorname{Ext}^n(B, A)$ and $\operatorname{Ext}^n(B, B)$ for all n.

2. Let $A = \mathbf{C}[x, y]/(xy)$ and let $B = A/(x, y)$. Compute $\operatorname{Ext}^n(B, A)$ and $\operatorname{Ext}^n(B, B)$ for all n.

3. Let $A = \mathbf{C}[x]/(x^2)$ and let $B = \mathbf{C}[x]/(x)$. Compute $\operatorname{Ext}^n(B, A)$ and $\operatorname{Ext}^n(B, B)$ for all n.

4. Let $\hat{\mathbf{Q}} = \varprojlim \mathbf{Q}/n\mathbf{Z}$. Prove that $\hat{\mathbf{Q}} \simeq \mathbf{R}$:

   (a) Show that $\hat{\mathbf{Q}}$ is divisible.

   (b) Show that $\hat{\mathbf{Q}}$ is torsion-free.

   (c) Conclude that $\hat{\mathbf{Q}}$ is a $\mathbf{Q}$-vector space.

   (d) Show that $\hat{\mathbf{Q}}$ has the cardinality of $\mathbf{R}$.

   (e) Conclude that $\hat{\mathbf{Q}}$ has a basis whose cardinality is the same as the cardinality of $\mathbf{R}$. (You may use the axiom of choice.)

   (f) Conclude that $\hat{\mathbf{Q}} \simeq \mathbf{R}$.

5. Complete the verification that Yoneda extensions $\operatorname{Y.Ext}(X, Y)$ (Yoneda extensions) has the structure of an abelian group.

6. Complete the verification that $\operatorname{Hom}(X, -)$ and $\operatorname{Y.Ext}(X, -)$ together form a truncated δ-functor. Why is the sequence constructed in class exact?