Math 256B. Homework 13 (Corrected)

Due Wednesday 1 May

1. Let k be a field. Compute the dualizing sheaf of the (reduced) scheme

$$X = V(z) \cup V(x,y) \subseteq \mathbb{P}^3_k .$$

(This is the union of a plane and a line in $\mathbb{P}^3_k$, which intersect at a point.)

2. Prove that the derived-functor cohomology class determined by the Čech cocycle α of (III, Remark 7.1.1) is invariant under automorphisms of $\mathbb{P}^n_k$. Do this by direct computation.

[**Hints:** You may find (II, Example 7.1.1) and Exercise 2 on Homework 12 useful. Remember elementary matrices. For information on differentials, see pages 172–173 and (II, 8.13) in Hartshorne.]

3(NC). Let k be a field, let $n \in \mathbb{Z}_{>0}$, and let $X = \mathbb{P}^n_k$. Conclude from the previous exercise that there is a *canonical* trace map

$$t\colon H^n(X, \omega_X) \to k .$$