Name: ______________________________

1. Give an example of a locally ringed space that is not a scheme.

2. Give an example of a pair of locally ringed spaces $(X, \mathcal{O}_X)$, $(Y, \mathcal{O}_Y)$ and a map of ringed spaces $(\pi, \pi^*) : (X, \mathcal{O}_X) \to (Y, \mathcal{O}_Y)$ that is *not* a map of locally ringed spaces. Can you find an example with $(X, \mathcal{O}_X) = \mathrm{Spec}(R)$, $(Y, \mathcal{O}_Y) = \mathrm{Spec}(S)$ for some rings R, S?

3. Let $R \subset \mathbb{C}[x, y] \times \mathbb{C}[u, v]$ be the subring of pairs $(p(x, y), q(u, v))$ of polynomials such that $p(0, 0) = q(0, 0)$.
   1. Describe $\mathrm{Spec}(R)$ and the induced map $\mathbb{A}^2 \coprod \mathbb{A}^2 \to \mathrm{Spec}(R)$.
   2. Consider the ideal $I = (x, y, u, v) \subset R$. Calculate the sections $\mathcal{O}_{\mathrm{Spec}(R)}(\mathrm{Spec}(R) \setminus V(I))$.
   3. Is $\mathcal{O}_{\mathrm{Spec}(R)}(\mathrm{Spec}(R) \setminus V(I))$ a localization of R with respect to some multiplicative subset?