1a.4. The assumption $X_{i+1} = \rho X_i$ should read: $X_{i+1} = \rho X_i + \varepsilon_i$, where ε_i are i.i.d. with mean 0 and variance $\sigma^2(1 - \rho^2)$, and $\mathrm{Cov}(X_i, \varepsilon_i) = 0$.

2a.3. Assume $|\rho| < 1$.