# Problem Set 4 - Scalar field dynamics during inflation

1. Using Eqs. (190) and (185), or otherwise, show that eternal inflation occurs at the maximum of a potential of the form
$$V = V_0 - \frac{1}{2}m^2\phi^2 + \dots$$
if $m^2 \leq 6V_0$.

2. Consider a quantized real scalar field $\phi$ with slow-roll potential $V(\phi)$ in de Sitter space. Split the scalar field into two parts, a short wavelength approximately free and massless quantum part $\phi_{\rm s}(t, \mathbf{x})$ containing the Fourier modes with $k \gtrsim aH$, and a smoothed approximately classical part $\phi_{\rm l}(t, \mathbf{x})$ containing the Fourier modes with $k \ll aH$. Use appropriate approximations to derive the classical stochastic equation of motion for $\phi_{\rm l}(t, \mathbf{x})$ in a simple and compact form.