

Problem Set 5 - Perturbations generated during inflation

1. Derive

$$n_{\mathcal{R}_c} = 1 + 2\frac{V''}{V} - 3\left(\frac{V'}{V}\right)^2$$

from

$$P_{\mathcal{R}_c} = \left(\frac{H}{2\pi}\right)^2 \left(\frac{H}{\dot{\phi}}\right)^2$$

2. Using suitable approximations, calculate the spectrum and spectral index of the curvature perturbations produced during rolling scalar field inflation with potential

$$V = V_0 - \frac{1}{2}m^2\phi^2 + \dots$$

Do *not* use the slow-roll approximation.

3. Make a rough estimate of the spectrum and spectral index of the perturbations produced by thermal fluctuations during thermal inflation.