først har vi vores startligninger

$$\dot{\delta}^{(1)} = -\theta^{(1)} \quad \dot{\theta}^{(1)} = -\mathcal{H}\theta^{(1)} - \frac{3}{2}\frac{H_0^2\Omega_M}{a}\delta_{cdm}^{(1)} + c_s^2\delta^{(1)} \tag{3.41}$$

$$\dot{\delta}_\nu = -2\partial_j\nabla^{-2}\theta^{(1)}\partial_j\delta^{(1)} - 2\delta^{(1)}\theta^{(1)} - \theta^{(2)} \tag{3.42}$$

$$\dot{\theta}^{(2)} = -\mathcal{H}\theta^{(2)} - 2\Big(\partial_i\partial_j\nabla^{-2}\theta^{(1)}\partial_i\partial_j^{(1)}\Big) - 2\partial_j\nabla^{-2}\theta^{(1)}\partial_j\theta^{(1)} \tag{3.43}$$

$$-\frac{3}{2}\frac{H_0^2\Omega_M}{a}\delta^{(2)} \tag{3.44}$$

$$\ddot{\delta}_\nu^{(2)} + \mathcal{H}\dot{\delta}_\nu^{(2)} + c_s^2\Big[\delta_\nu^{(2)} + 2\delta_\nu^{(1)}\delta_\nu^{(1)} + 2\partial_j\nabla^{-2}\delta_\nu^{(1)}\partial_j\delta_\nu^{(1)}\Big] \tag{3.45}$$

$$= \frac{3}{2}H_0^2\frac{\Omega_M}{a}\Big[\delta_{cdm}^{(2)} + 2\delta_\nu^{(1)}\delta_{cdm}^{(1)} + 2\partial_j\nabla^{-2}\delta_{cdm}^{(1)}\partial_j\delta_\nu^{(1)}\Big] \tag{3.46}$$

$$+4\partial_j\nabla^{-2}\dot{\delta}_\nu^{(1)}\partial_j\dot{\delta}_\nu^{(1)} + 2\dot{\delta}_\nu^{(1)}\dot{\delta}_\nu^{(1)} + 2\Big(\partial_j\partial_i\nabla^{-2}\dot{\delta}_\nu^{(1)}\Big)^2 \tag{3.47}$$

Let the approximating begin

$$\ddot{\delta}_\nu^{(2)} + \mathcal{H}\dot{\delta}_\nu^{(2)} \tag{3.48}$$

$$= \frac{3}{2}H_0^2\frac{\Omega_M}{a}\Big[\delta_{cdm}^{(2)} + 2\delta_\nu^{(1)}\delta_{cdm}^{(1)} + 2\partial_j\nabla^{-2}\delta_{cdm}^{(1)}\partial_j\delta_\nu^{(1)}\Big] \tag{3.49}$$

$$+4\partial_j\nabla^{-2}\dot{\delta}_\nu^{(1)}\partial_j\dot{\delta}_\nu^{(1)} + 2\dot{\delta}_\nu^{(1)}\dot{\delta}_\nu^{(1)} + 2\Big(\partial_j\partial_i\nabla^{-2}\dot{\delta}_\nu^{(1)}\Big)^2 \tag{3.50}$$

$$\delta_{cdm}^{(1)} \propto a \tag{3.51}$$

$$\ddot{\delta}_\nu^{(2)} + \mathcal{H}\dot{\delta}_\nu^{(2)} \tag{3.52}$$

$$= \frac{3}{2}H_0^2\frac{\Omega_M}{a}\Big[\delta_{cdm}^{(2)} + 2\delta_\nu^{(1)}a + 2\partial_j\nabla^{-2}\delta_{cdm}^{(1)}\partial_j\delta_\nu^{(1)}\Big] \tag{3.53}$$

$$+ 4\partial_j\nabla^{-2}\dot{\delta}_\nu^{(1)}\partial_j\dot{\delta}_\nu^{(1)} + 2\dot{\delta}_\nu^{(1)}\dot{\delta}_\nu^{(1)} + 2\Big(\partial_j\partial_i\nabla^{-2}\dot{\delta}_\nu^{(1)}\Big)^2 \tag{3.54}$$