først har vi vores startligninger

$$\dot{\delta}^{(1)} = -\theta^{(1)} \quad \dot{\theta}^{(1)} = -\mathcal{H}\theta^{(1)} - \frac{3}{2}\frac{H_0^2\Omega_M}{a}\delta_M^{(1)} - c_s^2\nabla^2\delta^{(1)} \tag{4.41}$$

$$\dot{\delta}_\nu^{(2)} = -2\partial_j\nabla^{-2}\theta^{(1)}\partial_j\delta^{(1)} - 2\delta^{(1)}\theta^{(1)} - \theta^{(2)} \tag{4.42}$$

$$\dot{\theta}^{(2)} = -\mathcal{H}\theta^{(2)} - 2\Big(\partial_i\partial_j\nabla^{-2}\theta^{(1)}\partial_i\partial_j\theta^{(1)}\Big) - 2\partial_j\nabla^{-2}\theta^{(1)}\partial_j\theta^{(1)} \tag{4.43}$$

$$-\frac{3}{2}\frac{H_0^2\Omega_M}{a}\delta_M^{(2)} - c_s^2\nabla^2\delta^{(2)} \tag{4.44}$$

bedre opskrivning

$$\ddot{\delta}^{(2)} + \mathcal{H}\dot{\delta}^{(2)} = \frac{3}{2}\frac{H_0^2}{a}\Big(2\partial_j\nabla^{-2}\delta_M^{(1)}\partial_j\delta^{(1)} + 2\delta^{(1)}\delta_M^{(1)} + \delta_M^{(2)}\Big) \tag{4.45}$$

$$+c_s^2\Big(2\partial_j\delta^{(1)}\partial_j\delta^{(1)} + 2\delta^{(1)}\nabla^2\delta^{(1)} + \nabla^2\delta^{(2)}\Big) \tag{4.46}$$

$$4\partial_j\nabla^{-2}\dot{\delta}^{(1)}\partial_j\dot{\delta}^{(1)} + 2\dot{\delta}^{(1)}\dot{\delta}^{(1)} + 2\partial_i\partial_j\nabla^{-2}\dot{\delta}^{(1)}\partial_i\partial_j\nabla^{-2}\dot{\delta}^{(1)} \tag{4.47}$$

$$\ddot{\delta}^{(2)} + \mathcal{H}\dot{\delta}^{(2)} = \frac{3}{2}\frac{H_0^2}{a}\Big(2\partial_j\nabla^{-2}\delta_M^{(1)}\partial_j\delta^{(1)} + 2\delta^{(1)}\delta_M^{(1)} + \delta_M^{(2)}\Big) \tag{4.48}$$

$$+4\partial_j\nabla^{-2}\dot{\delta}^{(1)}\partial_j\dot{\delta}^{(1)} + 2\dot{\delta}^{(1)}\dot{\delta}^{(1)} + 2\partial_i\partial_j\nabla^{-2}\dot{\delta}^{(1)}\partial_i\partial_j\nabla^{-2}\dot{\delta}^{(1)} \tag{4.49}$$

$$a = \frac{1}{4}H_0^2\tau^2 \quad \delta^{(1)} = D\tilde{\delta} \quad \delta_M = a\tilde{\delta}_M \quad \mathcal{H} = H_0/\sqrt{a} = \frac{2}{\tau} \tag{4.50}$$

$$\tag{4.51}$$

Vi indsætter og ser hvad der sker,

$$\ddot{\delta}^{(2)} + \frac{2}{\tau}\dot{\delta}^{(2)} - c_s^2\nabla^2\delta^{(2)} - \frac{6}{\tau^2}\delta_M^{(2)} = \frac{6}{\tau^2}\Big(2\partial_j\nabla^{-2}a\tilde{\delta}_M^{(1)}\partial_j D\tilde{\delta}^{(1)} + 2D\tilde{\delta}^{(1)}a\tilde{\delta}_M^{(1)}\Big) \tag{4.52}$$

$$+4\dot{D}^2\partial_j\nabla^{-2}\tilde{\delta}^{(1)}\partial_j\tilde{\delta}^{(1)} + 2\dot{D}^2\tilde{\delta}^{(1)}\tilde{\delta}^{(1)} + 2\dot{D}^2\partial_i\partial_j\nabla^{-2}\tilde{\delta}^{(1)}\partial_i\partial_j\nabla^{-2}\tilde{\delta}^{(1)} \tag{4.53}$$

$$+c_s^2\Big(2\partial_j D\tilde{\delta}^{(1)}\partial_j D\tilde{\delta}^{(1)} + 2D\tilde{\delta}^{(1)}\nabla^2 D\tilde{\delta}^{(1)}\Big) \tag{4.54}$$

reducere

$$\ddot{\delta}^{(2)} + \frac{2}{\tau}\dot{\delta}^{(2)} - c_s^2\nabla^2\delta^{(2)} - \frac{6}{\tau^2}\delta_M^{(2)} = aD\frac{6}{\tau^2}\Big(2\partial_j\nabla^{-2}\tilde{\delta}_M^{(1)}\partial_j\tilde{\delta}^{(1)} + 2\tilde{\delta}^{(1)}\tilde{\delta}_M^{(1)}\Big) \tag{4.55}$$

$$+4\dot{D}^2\Big(\partial_j\nabla^{-2}\tilde{\delta}^{(1)}\partial_j\tilde{\delta}^{(1)} + 2\tilde{\delta}^{(1)}\tilde{\delta}^{(1)} + 2\partial_i\partial_j\nabla^{-2}\tilde{\delta}^{(1)}\partial_i\partial_j\nabla^{-2}\tilde{\delta}^{(1)}\Big) \tag{4.56}$$

$$+c_s^2D^2\Big(2\partial_j\tilde{\delta}^{(1)}\partial_j\tilde{\delta}^{(1)} + 2\tilde{\delta}^{(1)}\nabla^2\tilde{\delta}^{(1)}\Big) \tag{4.57}$$

$$\ddot{\delta}^{(2)} + \frac{2}{\tau}\dot{\delta}^{(2)} - c_s^2\nabla^2\delta^{(2)} - \frac{6}{\tau^2}\delta_M^{(2)} = D\frac{3}{2}H_0^2\Big(2\partial_j\nabla^{-2}\tilde{\delta}_M^{(1)}\partial_j\tilde{\delta}^{(1)} + 2\tilde{\delta}^{(1)}\tilde{\delta}_M^{(1)}\Big) \tag{4.58}$$

$$+4\dot{D}^2\Big(\partial_j\nabla^{-2}\tilde{\delta}^{(1)}\partial_j\tilde{\delta}^{(1)} + 2\tilde{\delta}^{(1)}\tilde{\delta}^{(1)} + 2\partial_i\partial_j\nabla^{-2}\tilde{\delta}^{(1)}\partial_i\partial_j\nabla^{-2}\tilde{\delta}^{(1)}\Big) \tag{4.59}$$

$$+c_s^2D^2\Big(2\partial_j\tilde{\delta}^{(1)}\partial_j\tilde{\delta}^{(1)} + 2\tilde{\delta}^{(1)}\nabla^2\tilde{\delta}^{(1)}\Big) \tag{4.60}$$