Homework problems #10

1. Show that the "retarded-potential"

$$h_{\mu\nu}(t,\vec{x}) = 4\pi \int d^3x' \frac{S_{\mu\nu}(t-|\vec{x}-\vec{x'}|,\vec{x'})}{|\vec{x}-\vec{x'}|}$$

that is a solution of the graviton equation of motion in the harmonic gauge

$$\Box h_{\mu\nu} = -16\pi G(T_{\mu\nu} - \frac{1}{2}\eta_{\mu\nu}T^{\alpha}{}_{\alpha})$$

indeed satisfies the harmonic gauge condition.

2. Expand the energy-momentum "tensor" of gravitational field

$$t_{\mu\nu} \equiv \frac{1}{8\pi G}\left[R_{\mu\nu} - \frac{1}{2}g_{\mu\nu}R^{\lambda}{}_{\lambda} - R^{(1)}{}_{\mu\nu} + \frac{1}{2}g_{\mu\nu}R^{(1)\lambda}{}_{\lambda}\right]$$

up to the second order in powers of the graviton field $h_{\mu\nu}(x)$.