1- [d'inverno 18.6] Establish the character of the coordiantes t and r in

$$ds^2 = -\left(1 - \frac{2m}{r} + \frac{q^2}{r^2}\right)dt^2 + \left(1 - \frac{2m}{r} + \frac{q^2}{r^2}\right)^{-1}dr^2 + r^2 d\Omega^2$$

for $q^2 < m^2$ in the regions I, II, III. Find the surfaces of infinite redshift.

2- Verify the weak field limit for the Reinssner-Nordstrom metric. Compare with a source of the form $\alpha\delta(x) + \beta r^{-4}$.

3- Draw Penrose diagram for Minkowski, Schwarztchild and Reinssner-Nordstrom. Draw timelike geodesics and characterize different senarios which can happen to a timelike geodesic.

4- What is the difference between Killing Horizon and event horizon?

5- Recall Raychaudhuri's equation. Assuming congruence of timelike geodesics be hypersurface orthogonal, so that $\omega_{\alpha\beta} = 0$, and let strong energy condition hold. Show that in this case

$$\theta^{-1}(\tau) \geq \theta_0^{-1} + \frac{\tau}{3}$$

where $\theta_0 \equiv \theta(0)$. Write your interpretation.