1. Two particles are initially $t = 0$ at a radius $r = 4GM$ (in Schwarzschild coordinates) from the center of a Schwarzschild black hole. Particle X moves along a null trajectory towards the singularity at $r = 0$ while particle Y remains at $r = 4GM$.
   a) On a Kruskal diagram, sketch the worldlines of these particles labeling the Kruskal coordinate values of the initial and final positions of the null path.
   b) Which of these particles (if any) are following a geodesic path. Explain.

2. Using the (2+1)-dimensional TOV equation for a star with density that varies as $\rho(r) = k/r$, determine the explicit form of the differential equation that must be solved to find $p(r)$, i.e. it should only involve $p, r$ and other known quantities. Do not attempt to solve it!