(1) Let $\gamma_0 \colon [0,1] \to M$ be a geodesic and let $Y(t)$ be a smooth vector field along γ.

Prove that there exists a smooth variation $\gamma(t,s)$ of $\gamma_0(t) = \gamma(t,0)$ such that $Y = \frac{\partial \gamma}{\partial s}$ along $\gamma_0(t)$.

(2) Let Y_1, Y_2 be two Jacobi fields along a geodesic γ.

Prove that $\langle Y_1, Y_2' \rangle - \langle Y_1, Y_2' \rangle$ is constant along γ.