1. Let $f : \mathbb{R}^3 \to \mathbb{R}$ be defined by $f(x, y, z) = y^2 + z^2 - \left(1 + \frac{1}{4}\cos(\pi x)\right)^2$, let $S = \{(x, y, z) : f(x, y, z) = 0\}$. The gradient of $f$ is nonzero at every point of $S$, so $S$ is a surface. Verify that the curves defined by 

\begin{align*}
\gamma(t) &= (0, 5/4 \cos(t), 5/4 \sin(t)), \\
\gamma(t) &= (1, 3/4 \cos(t), 3/4 \sin(t))
\end{align*}

are geodesics of $S$.

2. Let $r : \mathbb{R} \to \mathbb{R}$ be a smooth positive function, let $S$ be the surface of revolution obtained by rotating the curve $(x, r(x), 0)$ around the $x$-axis. For $x_0 \in \mathbb{R}$ let 

\[\gamma(t) = (x_0, r(x_0) \cos(t), r(x_0) \sin(t))\]

Verify that $\gamma$ is a curve in $S$, then that it is a geodesic if and only if $x_0$ happens to be a critical point of $r$. 