A solution to **Problem 8.29** (Problem 8.33 in Korean edition). Let $\gamma(u) = (\cos u, \sin u, 0)$ and $\mathbf{e}_3 = (0, 0, 1)$.

$$\mathbf{x}^+(u,v) := \gamma(u) + v\gamma'(u) + v\mathbf{e}_3$$

$$\mathbf{x}^-(u,v) := \gamma(u) - v\gamma'(u) + v\mathbf{e}_3$$

If one writes explicitly, $\mathbf{x}^+(u,v) = ((\cos u - v\sin u), (\sin u + v\cos u), v)$. Hence $(\cos u - v\sin u)^2 + (\sin u + v\cos u)^2 - v^2 = 1 + v^2 - v^2 = 1$. One can similarly verify for the case of $\mathbf{x}^-(u,v)$.

Click here for a very nice video on how a hyperboloid is constructed as a ruled surface and it is applied to the construction of the Sagrada Familia Cathedral.