Problem. Let Φ be the Minkowski inner product, $\mathbf{r}(x_1, x_2) = \left(x_1, x_2, \sqrt{1 + x_1^2 + x_2^2}\right)$, and $g_{ij} = \Phi(\mathbf{r}_{x_i}, \mathbf{r}_{x_j})$. Show that

$$\det\left(\left[g_{ij}\right]\right) = \frac{1}{1 + x_1^2 + x_2^2}$$