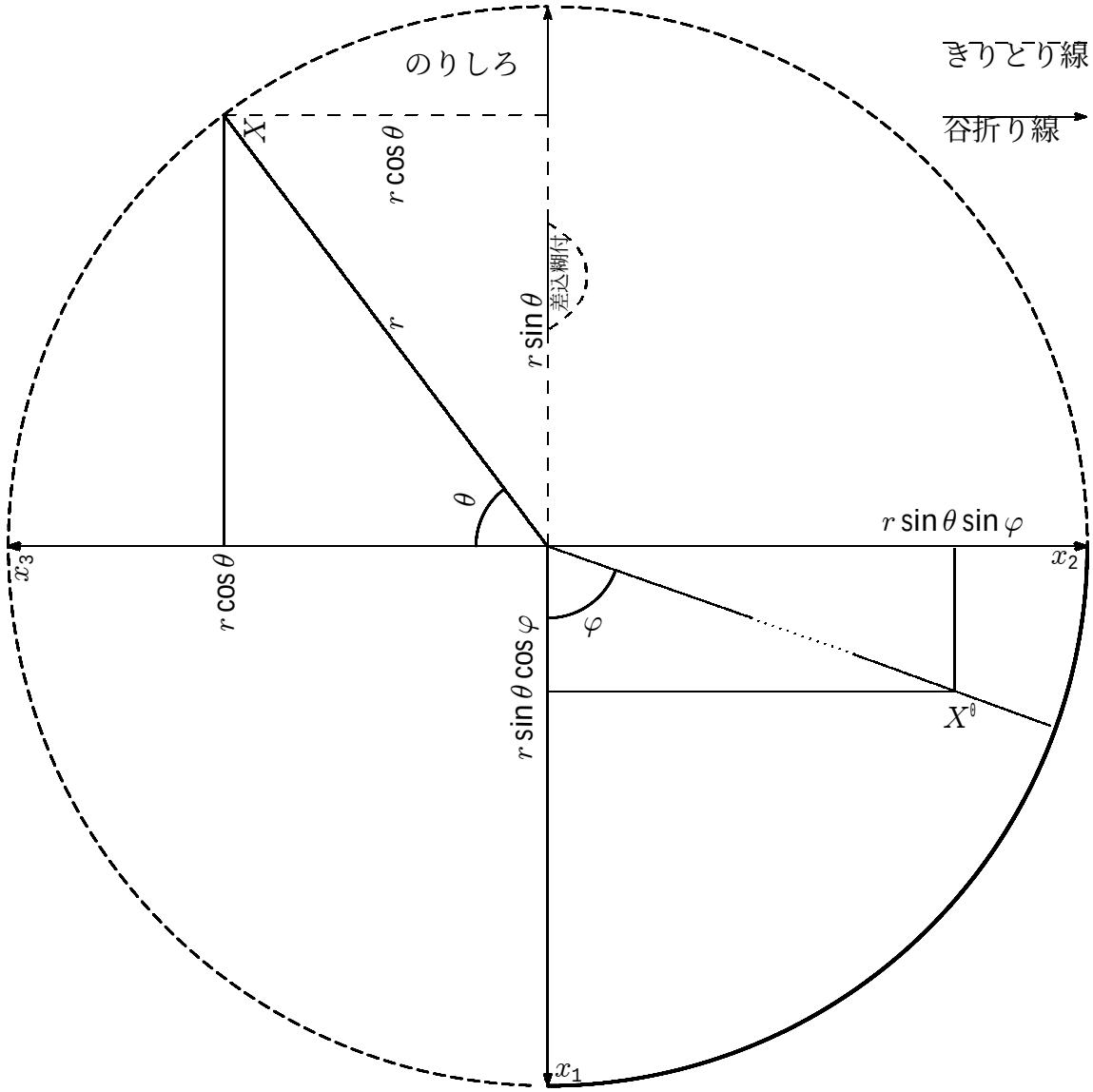

極座標変換 $(x_1, x_2, x_3) = (r\sin\theta\cos\varphi, r\sin\theta\sin\varphi, r\cos\theta)$ の Jacobi 行列と Jacobian は

$$\begin{pmatrix} \sin\theta\cos\varphi & r\cos\theta\cos\varphi & -r\sin\theta\sin\varphi \\ \sin\theta\sin\varphi & r\cos\theta\sin\varphi & r\sin\theta\cos\varphi \\ \cos\theta & -r\sin\theta & 0 \end{pmatrix}, \quad r^2\sin\theta.$$