(1) Compute the $\det[df]$ for the spherical coordinates map $f(r, \theta, \phi) = (r \cos\phi \cos\theta, r \cos\phi \sin\theta, r \sin\phi)$ and verify that it's a diffeomorphism of $U = \{r > 0, 0 < \theta < 2\pi, -\pi/2 < \phi < \pi/2$ onto $\mathbb{R}^3 \backslash \{x \geq 0, y = 0\}$

(2) Recall that a function $f\colon U \to \mathbb{R}$ on an open set $U \subset \mathbb{R}^n$ is called locally bounded if for any point $p \in U$ there exists $\epsilon > 0$ such that $B(p, \epsilon) \subset U$ and f is bounded on $B(p, \epsilon)$.

Prove that if f is locally bounded on U and $C \subset U$ is compact then f is bounded on C.