1.  **GLOBAL STRUCTURE**

    Determine the two families of null curves in the $(T, X)$ plane (i.e. with $Y$ and $Z$ constant) for the metric
    $$ds^2 = -dT^2 - 2\sinh(X)\, dT\, dX + dX^2 + dY^2 + dZ^2$$
    and express $T$ as a function of $X$ in each case. Define coordinates $U, V$ in terms of $X, T$ so that on each such null curve either $U$=constant or $V$=constant. By first transforming to coordinates $(U, V, Y, Z)$, or otherwise, find a coordinate transformation which shows that this metric is just the Minkowski metric
    $$ds^2 = -dt^2 + dx^2 + dy^2 + dz^2$$

    *HINT: The Minkowski metric in double-null coordinates takes the form*
    $$ds^2 = -du\, dv + dy^2 + dz^2$$
    *where $u = t - x$ and $v = t + x$.*