Exercise sheet 2

Hartle 7-2.
Show that the line-element

$$ds^2 = -dt^2 + 2dx\,dt + dy^2 + dz^2$$

corresponds to flat space-time.

Spherical coordinates.
Calculate for spherical coordinates $x = (r, \vartheta, \phi)$ in $\mathbb{R}^3$,

$$\begin{aligned} x'_1 &= r\sin\vartheta\cos\phi\,, \\ x'_2 &= r\sin\vartheta\sin\phi\,, \\ x'_3 &= r\cos\vartheta\,, \end{aligned}$$

the basis vectors $\vec{e}_r, \vec{e}_\vartheta$ and $\vec{e}_\phi$, the components of g_{ij} and $g \equiv \det(g_{ij})$. What is the physical "use/meaning" of $\sqrt{g}$?

Solutions are discussed Monday, 01.02.10