DIFFERENTIAL GEOMETRY 1, HOMEWORK 8 ADDENDUM

(1) Prove assertions (iii) and (iv) in Lemma 4.4 of the text.

(2) For the right helicoid $f(u, v) = (v \cos u, v \sin u, u)$, let $\mathbf{X} = \frac{\partial f}{\partial u}$ and $\mathbf{Y} = \frac{\partial f}{\partial v}$. Compute the directional derivatives $D_{\mathbf{X}}\mathbf{Y}$ and $D_{\mathbf{Y}}\mathbf{X}$, the covariant derivatives $\nabla_{\mathbf{X}}\mathbf{Y}$ and $\nabla_{\mathbf{Y}}\mathbf{X}$, and the directional derivatives $D_{\mathbf{X}}\nu$, $D_{\mathbf{Y}}\nu$.
(*Hint*: there are actually only four calculations to do here.)