1. (a) Do Carmo chapter 3 exercise 5(a), p. 81.
   (b) Consider $S^n$ with the round metric as a submanifold of $\mathbb{R}^{n+1}$ with coordinates $x^1, \ldots, x^{n+1}$. Show that for any $i, j$ ($1 \leq i, j \leq n + 1$), the vector field $x^i \partial_j - x^j \partial_i$ is a Killing field on $S^n$. (In particular, first check that it’s a vector field on $S^n$.)

2. Do Carmo chapter 3 exercise 5(b,c,d), pp. 81–82. (For the $\Rightarrow$ direction of 5(d), you could follow the hint in the book, but it’s easier just to use the formula for the Lie derivative from HW 4 # 4.)

3. Do Carmo chapter 3 exercise 7, p. 83. Hint: for standard coordinates $x^1, \ldots, x^n$ on $T_p M$, define vector fields $E_i = (\exp_p)_* (\partial/\partial x^i)$. Show that $\nabla_{E_i} E_j(p) = 0$ for all $i, j$, and then use Gram–Schmidt to modify $E_i$ to get orthonormality.