1. The Todd genus is the Chern genus corresponding to the analytic function \( f(z) = z/(e^z - 1) \). Express the Todd genus in terms of Chern classes up to and including terms of cohomological degree 6.

2. Let \( S^2 \) be the 2-sphere with the standard Riemannian metric \( ds^2 = d\theta^2 + \sin^2 \theta d\phi^2 \).

   (a) It is well known that using the stereographic projection one can parameterize the sphere minus a point by a complex coordinate \( z \). So one can use \( z \) and \( \bar{z} \) as complex coordinates on \( S^2 \). Compute the metric, the corresponding connection 1-form, and the curvature tensor of the tangent bundle of \( S^2 \) in terms of these coordinates. Note that \( TS^2 \) can be regarded as a complex rank-one bundle whose local trivialization is given by \( \frac{\partial}{\partial \bar{z}} \).

   (b) Compute the connection 1-form for the spinor bundle \( \Delta \) on \( S^2 \) and verify that the rank-two complex vector bundle \( \Delta \) with its connection decomposes into a sum \( \Delta_+ \oplus \Delta_- \), where \( \Delta_+ \otimes \Delta_+ \) is isomorphic to \( TS^2 \) (as a complex vector bundle with a connection), and \( \Delta_- \otimes \Delta_- \) is isomorphic to its dual.

   (c) Show that there are no nonzero harmonic spinors on \( S^2 \), in agreement with the index theorem.