1. (20 points) In advanced (nonlinear) constitutive equations, the strain tensor that is used has an important impact on what type of behavior the equation predicts. What is the strain tensor for the generalized linear viscoelastic Newtonian fluid constitutive equation? How did we show what the strain tensor was? (no need to re-derive; just discuss)

\[ \tau(t) = -\int_{-\infty}^{t} G(t - t') \dot{\gamma}(t') dt' \]

2. (10 points) Beginning with the deformation gradient tensor for shear (and its inverse) given in Table 9.3, calculate the Finger tensor and the Cauchy tensor for shear (answers also given in Table 9.3).

3. (20 points) Table 9.3 on page 329 shows the forms of various strain tensors in two familiar standard flows, shear and uniaxial elongation, and one additional standard flow, counterclockwise rotation around \( \hat{e}_3 \). We can write these tensors out directly because we know the flow fields for all three flows (they are part of the definitions of these standard flows). For the cessation of steady shear kinematics, what is the shear strain \( \gamma(t', t) \)? Note that the definition of \( \gamma \) appears in the caption of the table. What is the Finger tensor, \( G^{-1}(t, t') \) for cessation of steady shear? You must carry out the integral.

4. (30 points) Text 9.17 Calculate the cessation of steady shear material functions for the Lodge model.

5. (20 points) The Jeffreys model is a generalized linear viscoelastic Newtonian fluid model. What is the relaxation function \( G(t) \) for the Jeffreys model? (no need to derive; just report) Does the Jeffreys model predict nonzero \( \Psi_1 \) and \( \Psi_2 \) in steady shear flow? Does the Jeffreys model predict shear thinning? Comment on your answers.