AE 360
Homework 3
Due: Thursday, 30 January 1997, in class

1. Course notes, exercise on p. 29

2. Course notes, exercise on p. 33; give a computer generated plot of $T(x)$ in each case.

3. Consider SAE 30 oil in a Couette flow experiment in which the moving plate is pulled with a shear stress of $3 \times 10^4\ Pa$ and the gap width is 10 μm. Assume the bottom wall is stationary and thermally insulated, while the top wall is cooled in such a way that its temperature remains at 300 K. Do one analysis which assumes constant material properties and a second which allows for temperature dependent properties. You should find expressions for temperature dependent properties in a text such as White, Fox and McDonald, and Incropera and DeWitt. You will likely need to perform a numerical integration of ordinary differential equations for the variable properties calculation. I would recommend using mathematica to do the numerical integration. For each case, give computer generated plots of $u(y)$ and $T(y)$. I will post a sample mathematica file which does numerical integration in the documents section of the home page.

4. Moran and Shapiro, Third Edition, 11.8, p. 547; give a computer generated plot for $P(T)$ for this constant density system for each state equation for $-18\ C < T < 40\ C$.

5. Moran and Shapiro, Third Edition, 11.46, p. 549

6. Give a one paragraph summary of a research paper of Stokes. Include one or two of the key equations, taking care to ascribe physical meaning to each of the variables. Use a similar format as for the previous review. Use LaTeXand post your postcript file on your home page. Do not turn in a hard copy.