Due: To be announced. This time do any 5 of the 6 problems.

1. P. 178 problem 4.3

2. Prove $n$-dimensional analogs of (4.32) and (4.34). (I.e., assume $f$ is an $n$-dimensional tempered distribution and prove formulas that reduces to (4.32), (4.34) when $n = 1$.)

3. Prove $\{u/(\varepsilon^2 + u^2)\} \to pf \int u$ (hence proof of Example 8(c) p. 176 is complete).

4. Let $\chi$ denote the indicator function of the interval $(0, 1)$ and $g(x) = ix$. Show by calculation that the Fourier transform of $(\chi * g)$ equals the product of the Fourier transforms of $\chi$, $g$. (It may be useful to use a power series representation at some point.)

5. Verify formula (4.42) p. 179 under the assumption that $f$ and $g$ are $L^1$ functions on $\mathbf{R}$. Assume that any needed interchange of order of integration is valid. (It is, by “Fubini’s Theorem”.)

6. Let $u, v$ be tempered distributions on $\mathbf{R}^n$. Let $\partial_i$ denote the partial derivative operator in the $i$th variable. Prove $\frac{\partial}{\partial_i} (u * v)(x) = ((\frac{\partial}{\partial_i} u) * v)(x)$. 