# Physics 5455 – Problem set 2

1. Schwabl 2.2(a,c). Note that $\Theta(x)$ is the Heaviside step function:

$$\Theta(x) \;=\; \begin{cases} 0 & x < 0 \\ 1 & x > 0 \end{cases}$$

2. Schwabl 2.5(a,b,c).

3. (a) Show that

$$[AB, C] \;=\; A[B, C] \;+\; [A, C]B$$

(You proved an analogous result for Poisson brackets recently.)

(b) Show that

$$e^A e^B \;=\; e^B e^A e^{[A,B]}$$

when $[[A, B], A] \;=\; 0 \;=\; [[A, B], B]$. Hint: consider the $\lambda$ derivative of $e^{\lambda A} e^{\lambda B}$, $e^{\lambda B} e^{\lambda A} e^{\lambda^2 [A,B]}$.