References are to equations appearing in the course book.

## Problem 7.1

Consider a boxcar spin-density distribution with width $z_{0}$, centered at $z=0$, and given by $\rho(z)=\rho_{0} \operatorname{rect}\left(z / z_{0}\right)$. Find the signal $s(k)$ for this spin density from (9.15). The answer will involve the sinc function, $\operatorname{sinc}\left(\pi k z_{0}\right)$. Then check, using integral tables for example, that the answer gives back the correct spin density through the inverse transform (9.17).

## Problem 7.2

Spins with gyromagnetic ratio $\gamma$ are uniformly distributed with uniform spin density $\rho_{0}$ along the $z$-axis from $-z_{0}$ to $z_{0}$ in a 1 D imaging experiment. Suppose that they are excited at $t=0$ by an rf pulse such that the signal at that instant would be given by

$$
\begin{equation*}
s(t=0)=\int_{-z_{0}}^{z_{0}} d z \rho_{0}=2 z_{0} \rho_{0} \tag{9.40}
\end{equation*}
$$

A negative constant gradient field $-G$ is immediately applied at $t=0^{+}$and flipped to the positive gradient field $+G$ at time $t=T$. Find an expression for the signal for $t>T$ and show that it exhibits a gradient echo at time $t=2 T$.

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[^0]:    The problems are based on those in Robert W. Brown, Y.-C. Norman Cheng, E. Mark Haacke, Michael R. Thompson, Ramesh Venkatesan. Magnetic Resonance Imaging: Physical Principles and Sequence Design, 2nd Edition, Wiley, 2014.

