Relevant reading: Chapter 5.
Relevant items in the DSP First CD: Homework Problems: 5.18–5.29, 5.3, 5.12–5.17.

1. 5.1 a, b, c, p. 152

2. 5.2, p. 153

   Additional parts:

   (d) Is the filter causal?

   (e) Find the order of the filter.

3. 5.6, pp. 154-5

4. 5.7, p. 155

   In addition, for those systems that are not time-invariant, find an example of an input signal $x[n]$ and a time n_0 such that the response to $x[n - n_0]$ is not the same as $y[n - n_0]$, where $y[n]$ is the response to $x[n]$. Plot $x[n - n_0]$, $y[n - n_0]$ and the response of the system to $x[n - n_0]$.

5. 5.11, p. 156

6. Suppose a filter with impulse response $h[n]$ has input signal $x[n]$ that is periodic with period n_0. Show that the output $y[n]$ is periodic with period n_0.

   Hint: Starting by writing down the definition of what it means for $y[n]$ to be periodic period n_0. Also write a formula for $y[n]$ in terms of $x[n]$ and $h[n]$. There are two such formulas, one of which will be easier to work with.

7. A filter has coefficients $b_0 = 2$, $b_1 = -1$, $b_2 = 1$. The input signal is the complex exponential signal

   $$x[n] = 2e^{j(0.3\pi n + .1)}.$$

   Find the output signal $y[n]$. Simplify the expression for $y[n]$ as much as possible.

   Hint: Can you express $y[n]$ as a complex exponential signal in standard form? Do not use the methods of Chapter 6. Use only the methods of Chapter 5.