EE 3054 - Quiz 12 Fall 2012

1) The impulse response of an LTI system is

$$h(t) = 2 \exp(-2 t) u(t) - 2 \exp(-t) \cos(2 t) u(t)$$

a) List the poles of the system
b) Find the differential equation describing the system
c) What is the dc gain of the system?
d) Sketch the output signal produced by input $x(t) = 2$.

2) A causal LTI system is described by the differential equation

$$y''(t) + 2 y'(t) + 10 y(t) = x'(t) + 2 x(t)$$

a) Find the poles and zeros. Accurately sketch the pole/zero diagram.

b) Write the form of the impulse response (you need not computed the residues).

c) Find the transfer function H(s)

3) The impulse response of an LTI system is

$$h(t) = 3 \exp(-t) u(t-2)$$

Note: u(t-2) not u(t) in h(t).
a) Find the frequency response Hf(w)
b) Find and sketch $|Hf(w)|$

4) The frequency response of an LTI system is

$$Hf(w) = \begin{cases} 0 & \text{for } |w| < 3\pi \\ jw & \text{for } |w| > 3\pi \end{cases}$$

a) Sketch the frequency response magnitude $|Hf(w)|$
b) Sketch the frequency response phase $<Hf(w)$
c) Find the output signal produced by the input signal

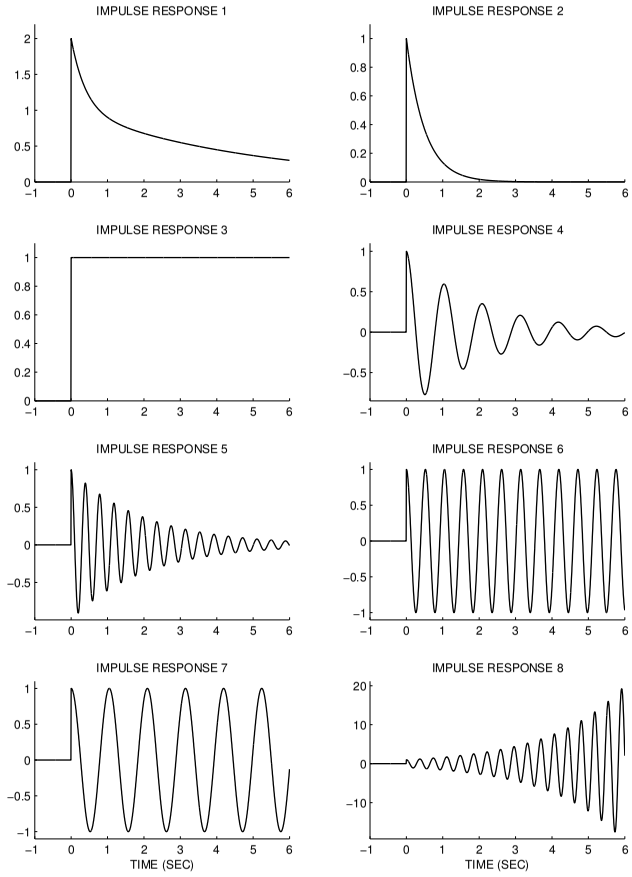
$$x(t) = 1 + \cos(\pi t) + \cos(4 \pi t) + \sin(5 \pi t)$$

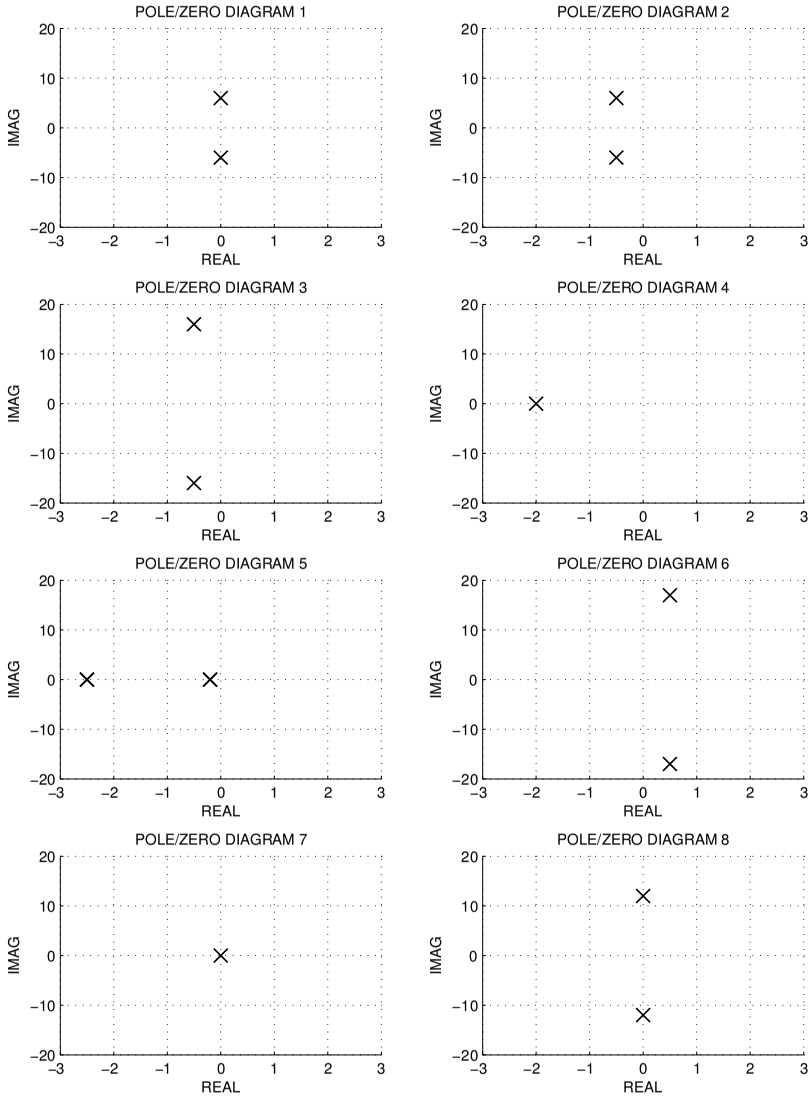
More problems on following pages.

5)

The first six seconds of the impulse responses of eight causal continuous-time systems are illustrated below, along with the pole/zero diagram of each system. But they are out of order. Match the figures with each other by completing the table.

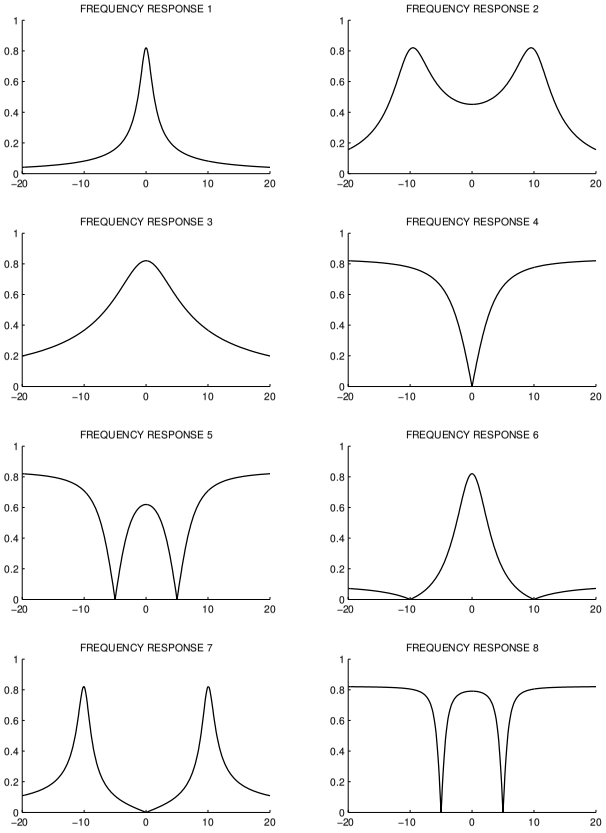
IMPULSE RESPONSE	POLE-ZERO DIAGRAM
1	
2	
⋮	
8	

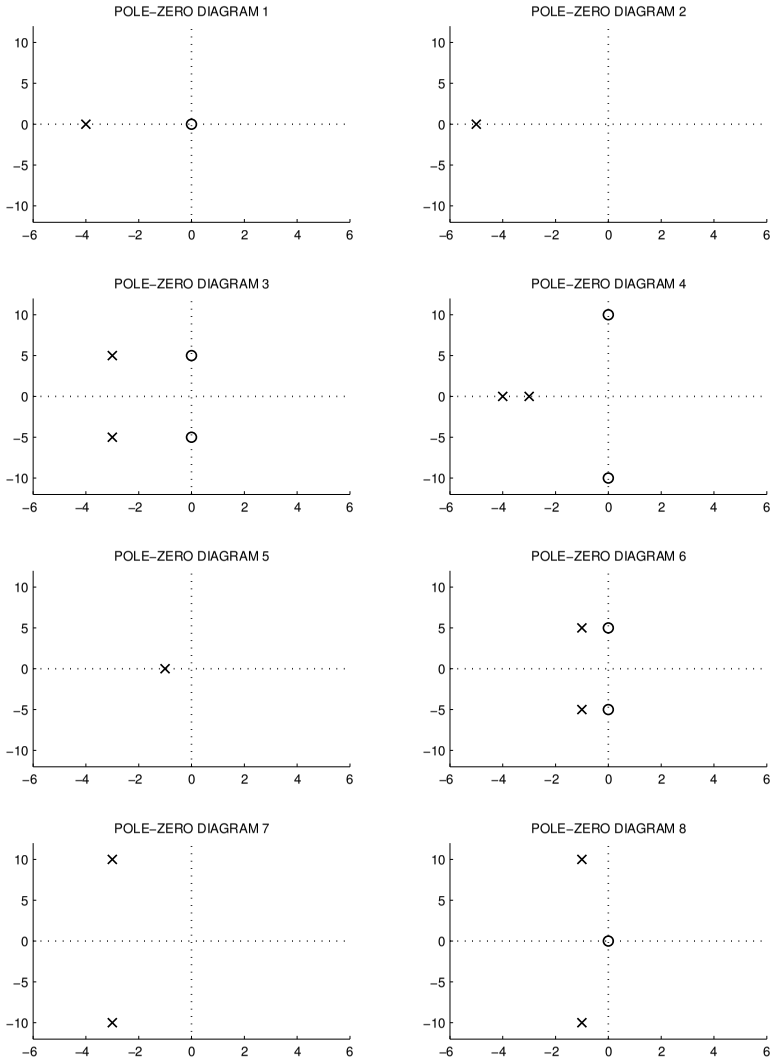




The frequency responses of eight causal continuous-time systems are illustrated below, along with the pole/zero diagram of each system. But they are out of order. Match the figures with each other by completing a table.

FREQUENCY RESPONSE	POLE-ZERO DIAGRAM
1	
2	
3	
4	
5	
6	
7	
8	

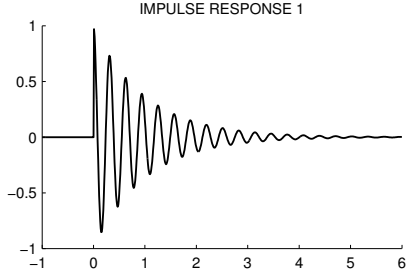


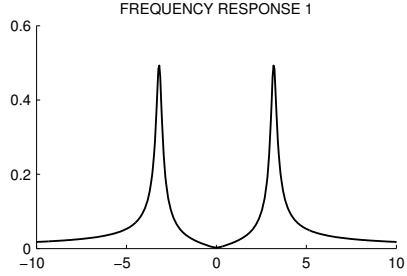


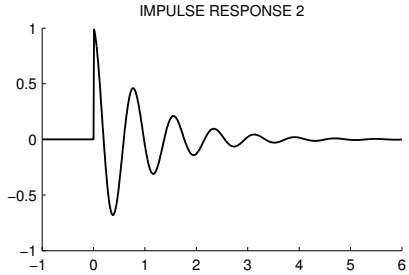
7)

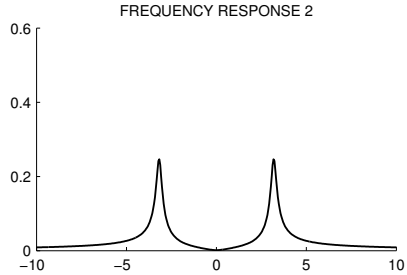
The figure shows the impulse responses and frequency responses of four continuous-time LTI systems. But they are out of order. Match the impulse response to its frequency response magnitude, and *explain* your answer.

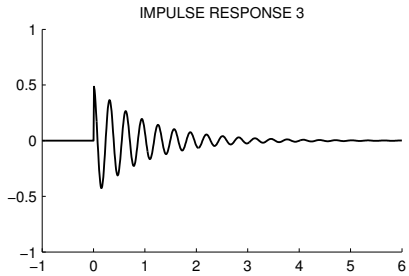
IMPULSE RESPONSE	FREQUENCY RESPONSE
1	
2	
3	
4	

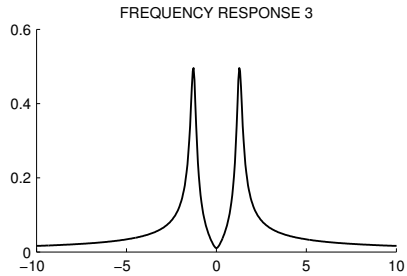


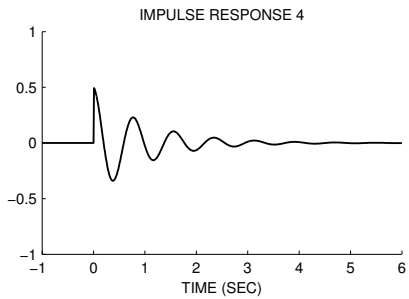


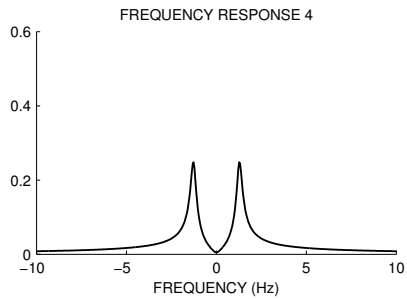








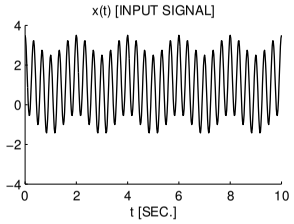




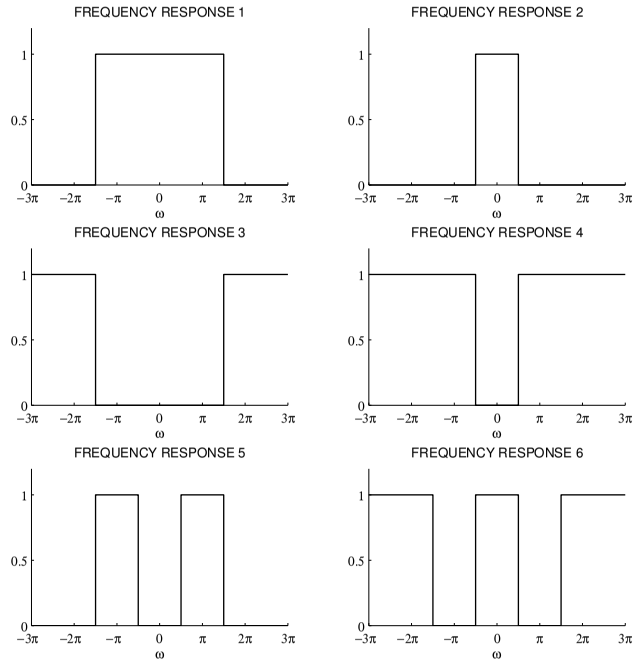
A signal $x(t)$, comprised of three components,

$$x(t) = 1 + 0.5\cos(\pi t) + 2\cos(6\pi t)$$

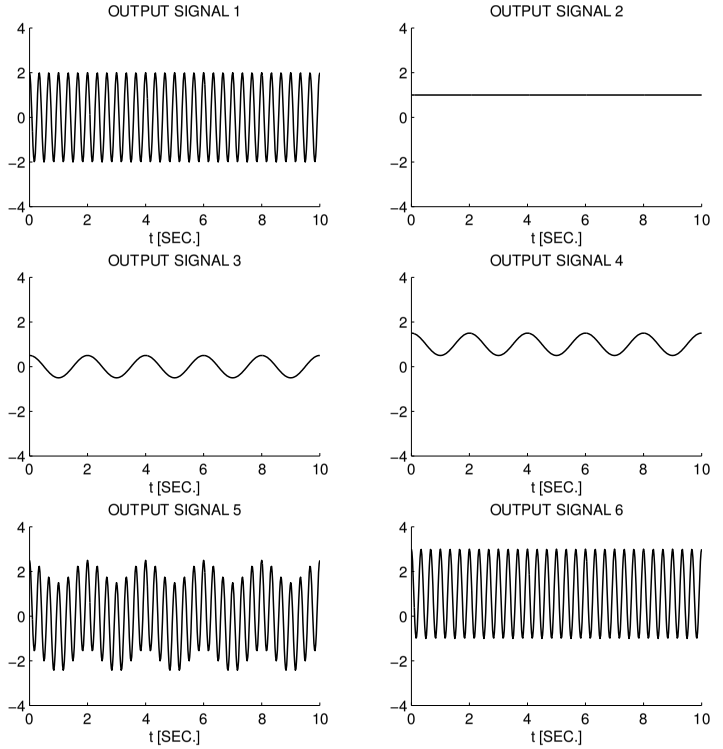
is illustrated here:



This signal, $x(t)$, is filtered with each of six different continuous-time LTI filters. The frequency response of each of the six systems are shown below. (For $|\omega| > 3\pi$, each frequency response has the value it has at $|\omega| = 3\pi$.)



The six output signals are shown below, but they are not numbered in the same order.



Match each output signal to the system that was used to produce it by completing the table.

System	Output signal
1	
2	
3	
4	
5	
6	