

① $h(t) = e^{-t} u(t) + e^{-t} \cos(t) u(t)$

is the impulse resp. of an LTI system.

- a) Find the difference equation of the system
- b) List the poles
- c) Find the output produced by the input $x(t) = 2$
- d) Find the output produced by the input $x(t) = 2u(t)$
[You can leave the residues of general constants.]

② An ^{causal} LTI system has the differential eq.

$$y''(t) + 4y'(t) + 5y(t) = 2x'(t) + 3x(t)$$

- a) Find the poles of the system.
- b) Write the form of the impulse response based on the poles.
- c) Find the transfer function $H(s)$.

③ The impulse response of an LTI system is $h(t) = 3e^{-2t} u(t)$

- a) Find the frequency response $H^f(\omega)$.
- b) Find & sketch $|H^f(\omega)|$

④ The freq. resp. of an LTI system is

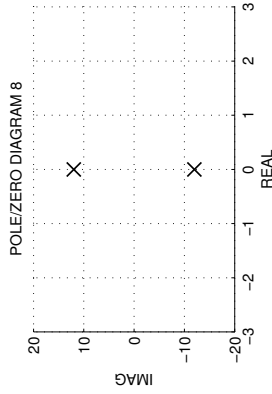
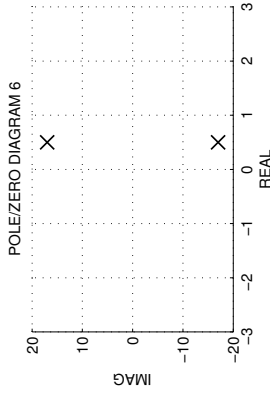
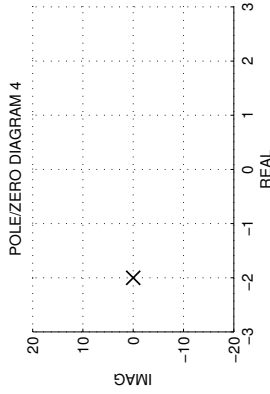
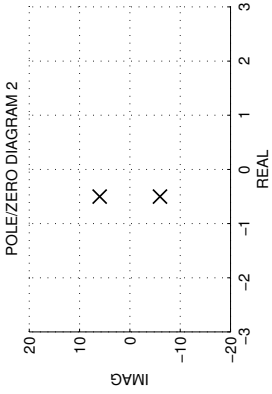
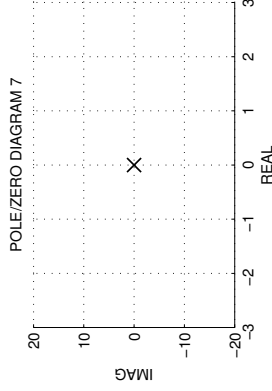
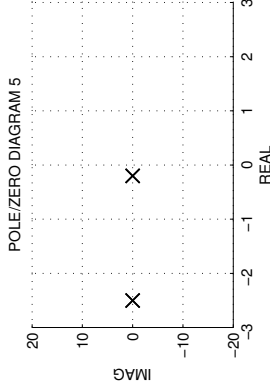
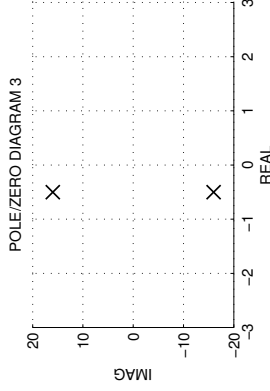
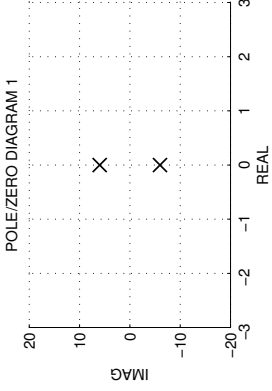
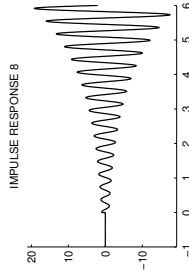
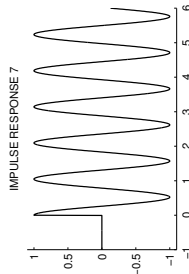
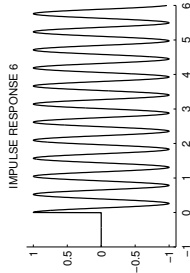
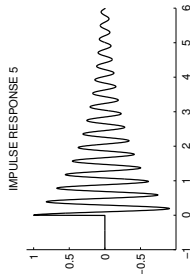
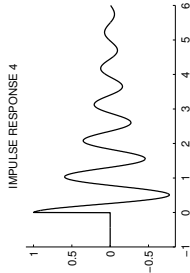
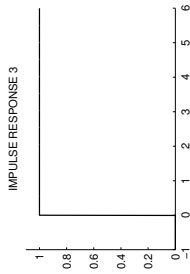
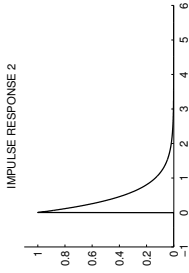
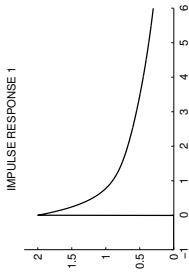
$$H^f(\omega) = \frac{1}{1 + \omega^2} e^{-j\omega}$$

- a) Find & sketch $|H^f(\omega)|$
- b) Find & sketch $\angle H^f(\omega)$
- c) Find output produced by input signal
 $x(t) = 1 + 2 \cos(2t)$

⑤ - ⑧, next pages..

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		

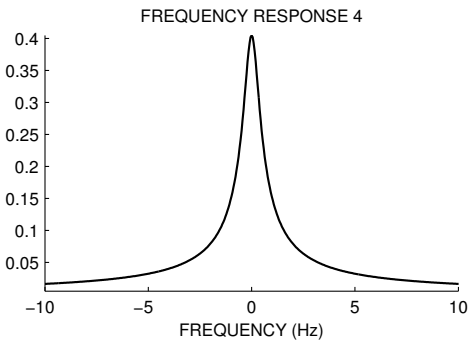
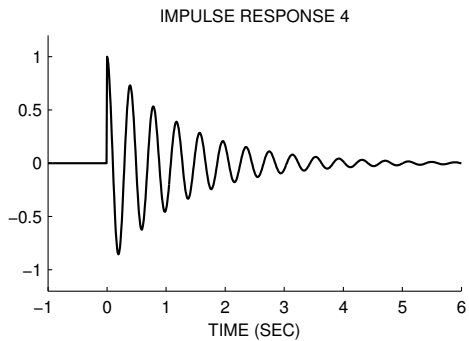
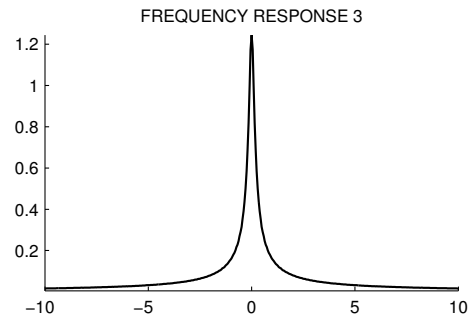
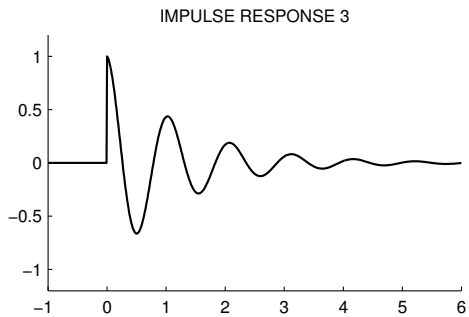
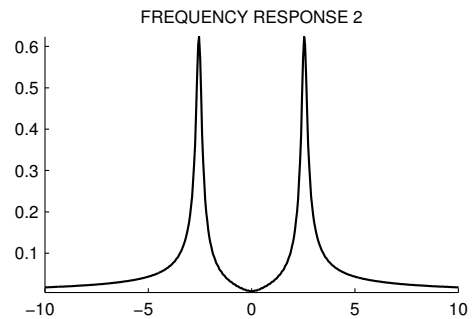
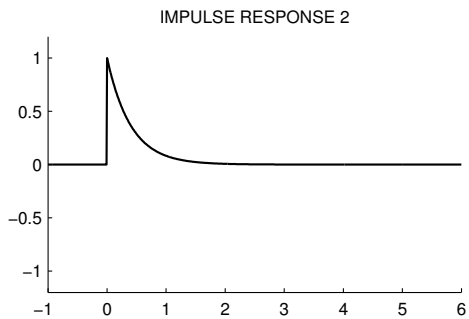
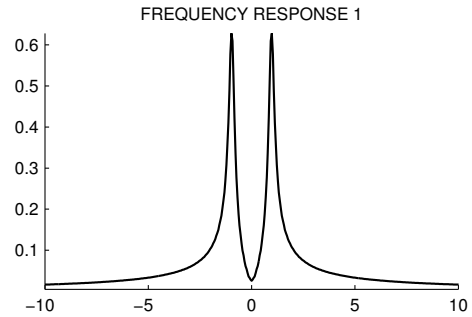
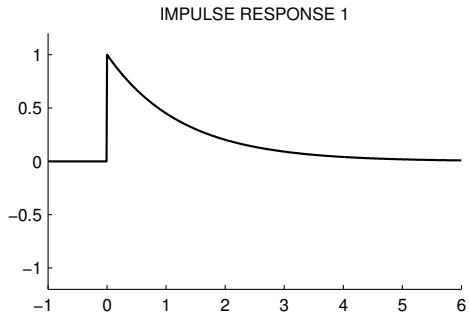


Problem 6

The figure shows the impulse responses and frequency responses of four continuous-time LTI systems. But they are out of order. Match each impulse response with its frequency response.

IMPULSE RESPONSE	FREQUENCY RESPONSE
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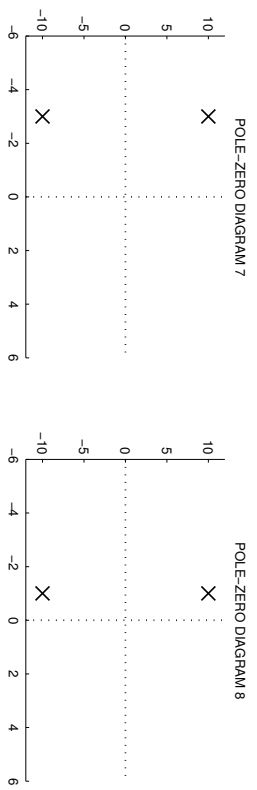
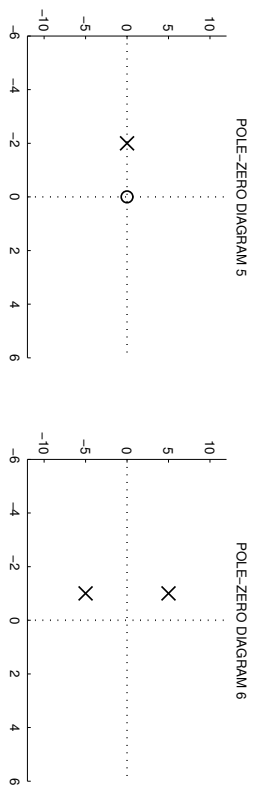
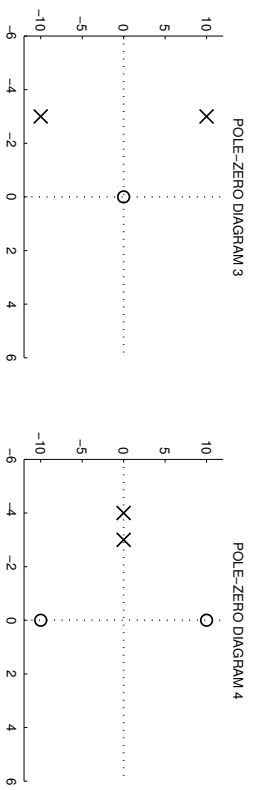
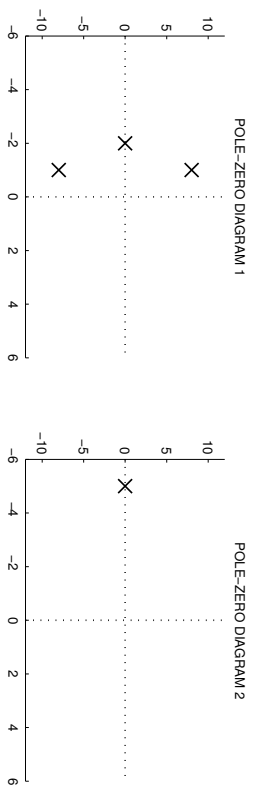
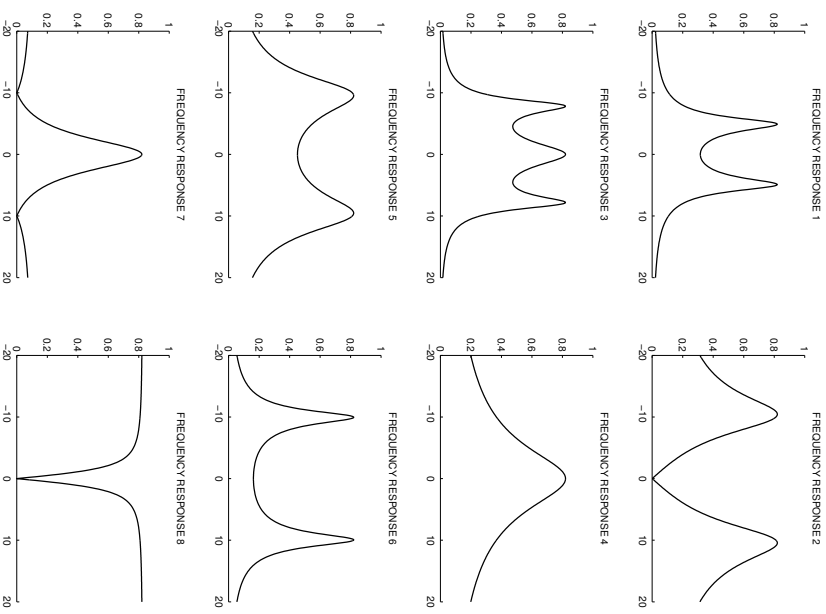
- 1
- 2
- 3
- 4



5. 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 the table (copy the table into your answer book).

FREQUENCY RESPONSE POLE-ZERO DIAGRAM

1	
2	
3	
4	
5	
6	
7	
8	



Problem 7

Each of the two continuous-time signals below are processed with each of four LTI systems. The two input signals, illustrated below, are given by:

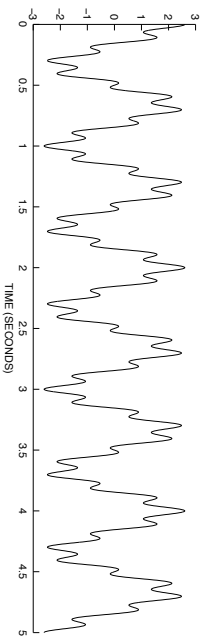
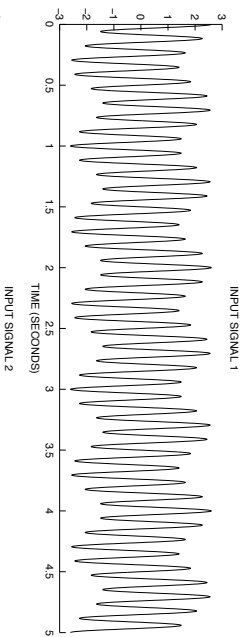
Input signal 1: $0.6 \cos(3\pi t) + 2 \cos(17\pi t)$

Input signal 2: $2 \cos(3\pi t) + 0.6 \cos(17\pi t)$

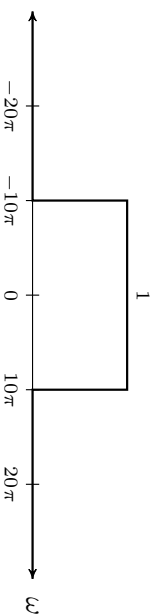
The frequency responses $H^f(\omega)$ are shown below. Indicate how each of the output signals are produced by completing the table below (copy the table onto your answer sheet). Note: one of the output signals illustrated below will appear twice in the table (there are seven distinct output signals).

Input signal	System	Output signal
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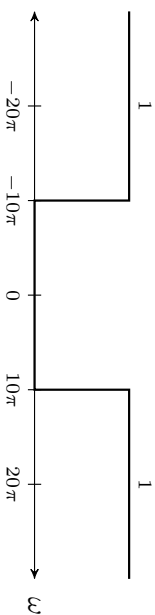
1	1	1
1	2	2
1	3	3
1	4	4
2	1	1
2	2	2
2	3	3
2	4	4



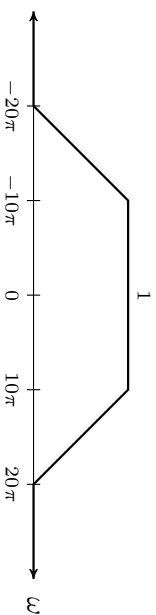
$H_1^f(\omega)$



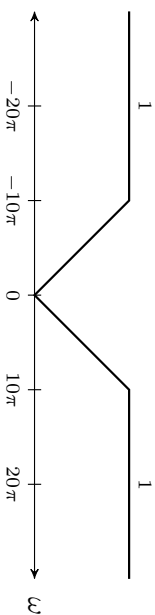
$H_2^f(\omega)$



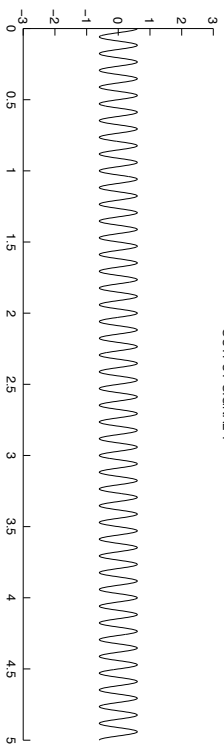
$H_3^f(\omega)$



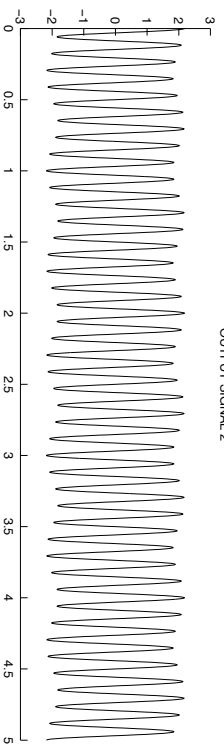
$H_4^f(\omega)$



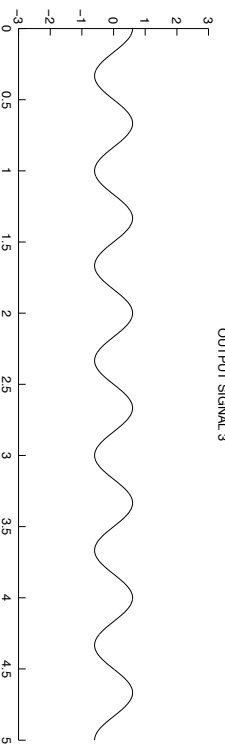
OUTPUT SIGNAL 1



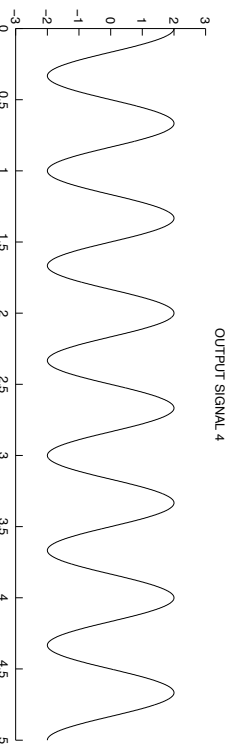
OUTPUT SIGNAL 2



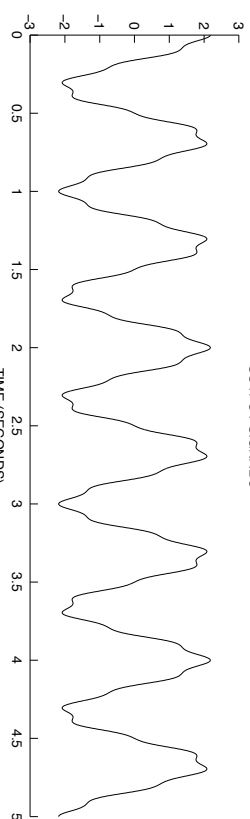
OUTPUT SIGNAL 3



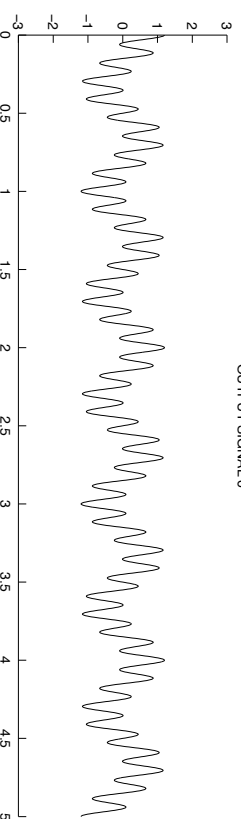
OUTPUT SIGNAL 4



OUTPUT SIGNAL 5



OUTPUT SIGNAL 6



OUTPUT SIGNAL 7

