1. An LTI system has impulse response

$$h(n) = \left(\frac{2}{3}\right)^n \sin\left(\frac{\pi}{3}\,n\right)\, u(n).$$

   (a) Derive a difference equation to implement the system. Show your work.

   (b) Find the poles and zeros of the system. Sketch the pole/zero diagram.

2. A causal LTI system is implemented by the difference equation

$$y(n) = x(n) + y(n-1) - \frac{1}{2}\,y(n-2).$$

   (a) Find the impulse response $h(n)$. Express $h(n)$ without j.

   (b) Find the poles and zeros of the system. Sketch the pole/zero diagram.

3. An LTI system has impulse response

$$h(n) = \left(\frac{1}{2}\right)^n u(n).$$

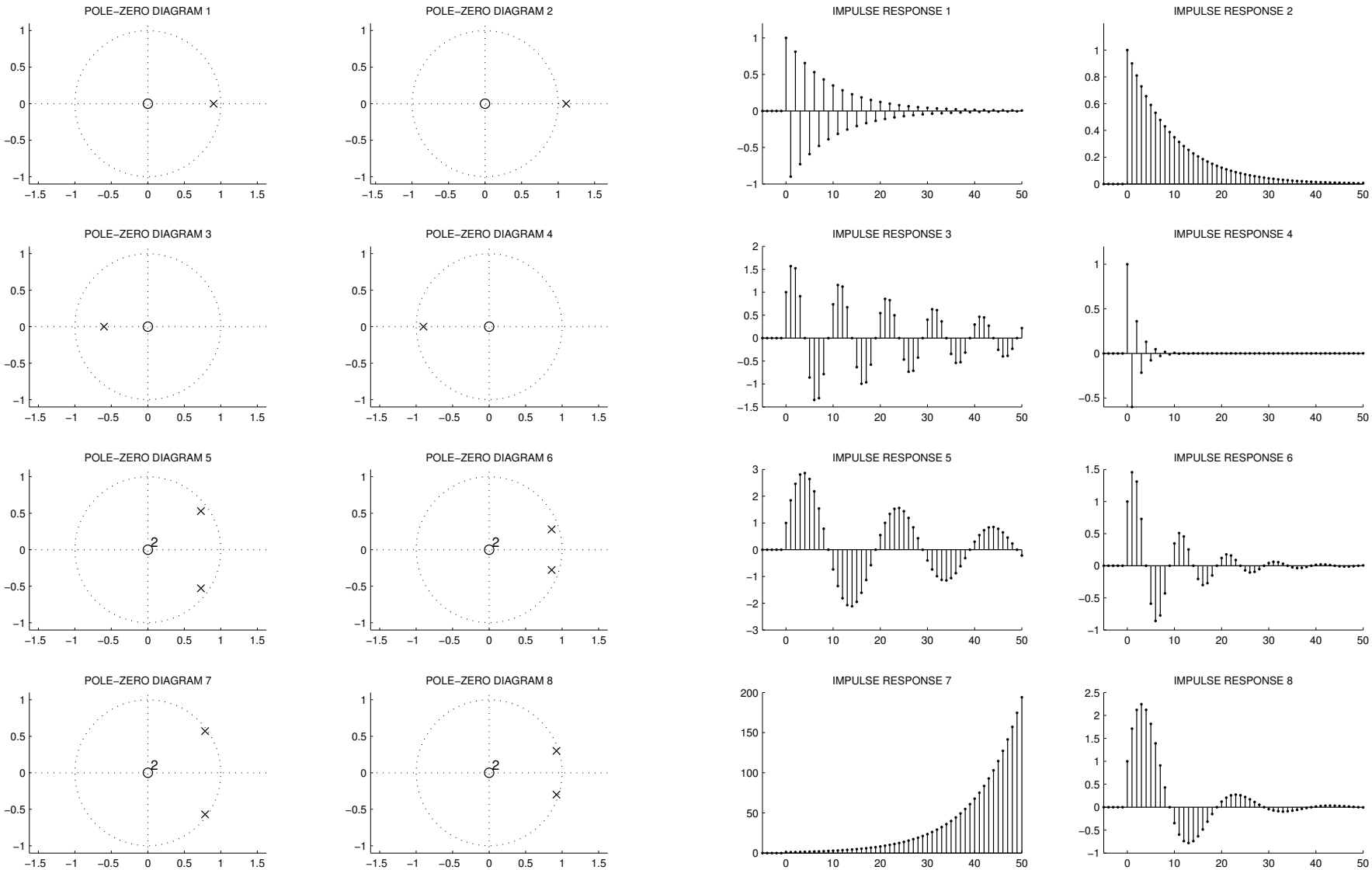
   Find the output signal $y(n)$ produced by input signal

$$x(n) = \left(\frac{1}{4}\right)^n \sin\left(\frac{\pi}{5}\,n\right)\, u(n).$$

   You need not find $y(n)$ exactly. Express $y(n)$ as accurately as possible without computing the residues in the partial fraction expansion. Your answer should not contain j.

4. The impulse responses and pole-zero diagrams of eight LTI systems are shown on the next page — but they are out of order. Match the systems by completing the table.

Pole-zero diagram	Impulse response
1	
2	
3	
4	
5	
6	
7	
8	


POLE−ZERO DIAGRAM 1
POLE−ZERO DIAGRAM 2
IMPULSE RESPONSE 1
IMPULSE RESPONSE 2
POLE−ZERO DIAGRAM 3
POLE−ZERO DIAGRAM 4
IMPULSE RESPONSE 3
IMPULSE RESPONSE 4
POLE−ZERO DIAGRAM 5
POLE−ZERO DIAGRAM 6
IMPULSE RESPONSE 5
IMPULSE RESPONSE 6
POLE−ZERO DIAGRAM 7
POLE−ZERO DIAGRAM 8
IMPULSE RESPONSE 7
IMPULSE RESPONSE 8