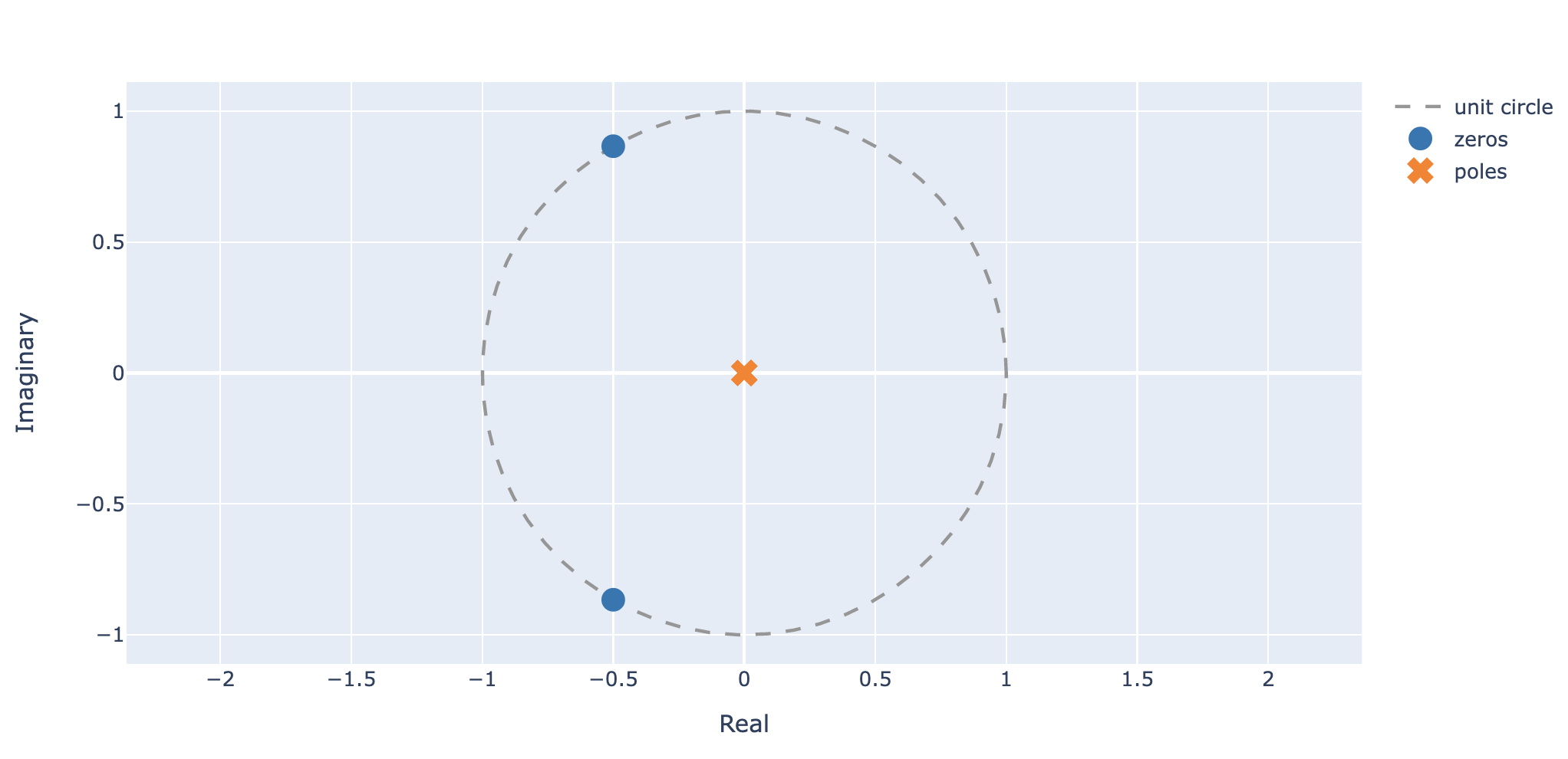
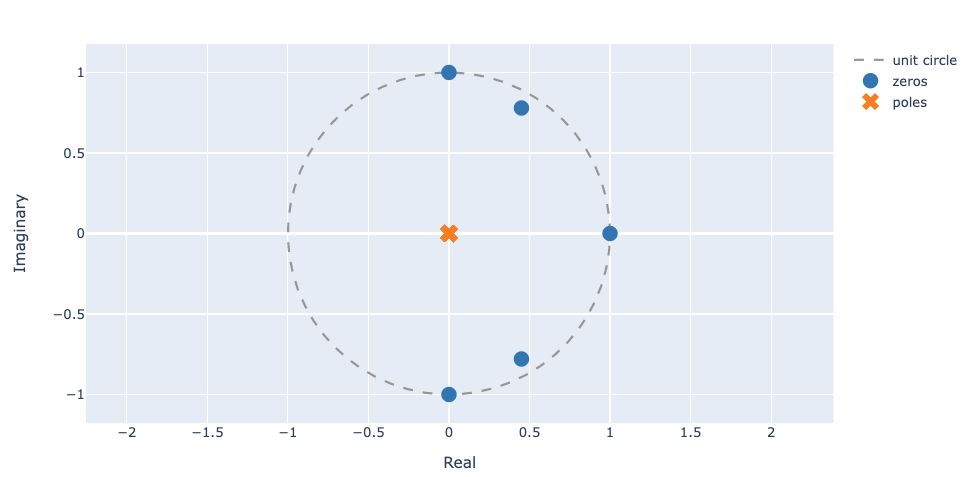
# Seminar 8: Z-Transform [solutions]

1. An LTI system is described by the difference equation
   1. Determine the system function *H*(*z*) for this system.  
      **ANSWER:**
   2. Plot the poles and zeros of *H*(*z*) in the *z*-plane.  
      **ANSWER:**zeros: poles:

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* 1. From *H*(*z*) obtain an expression for , the frequency response of the system.  
     **ANSWER:**
  2. What is the output if the input is  
     **ANSWER:**

1. Consider an LTI system whose system function is the product of five terms as follows
   1. Write the difference equation that relates the output of this system to its input.  
      **ANSWER**:
   2. Plot the poles and zeros of *H*(*z*) in the complex *z-*plane.  
      **ANSWER**:  
        
      
   3. If the input is , for what values of will .  
      **ANSWER**: If   
      note:   
      for , for only if x[n] is in the form with
2. Suppose that an LTI system is defined by the system function
   1. Write the time-domain description of this system in the form of a difference equation.  
      **ANSWER**:

* 1. Write a formula for the frequency response of the system.  
     **ANSWER**:
  2. Derive simple formulas for the magnitude response and the phase response versus . These formulas must contain no complex terms and no square roots.  
     **ANSWER**:  
       
     <
  3. This system can “null” certain input signals. For which input frequencies is the response to equal to zero?  
     **ANSWER**: when iff
  4. When the input to the system is , determine the output signal in the form . Give numerical values for the constants , , and .  
     **ANSWER**:

1. An LTI system has the system function

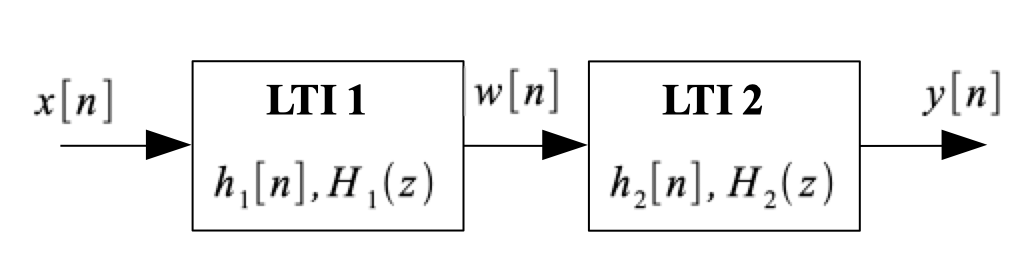
The input to the system is

for . Determine the output of the system corresponding to the above input. Give an equation for that is valid for all *n*.

***Note:*** This is an easy problem if you approach it correctly.  
**ANSWER**:

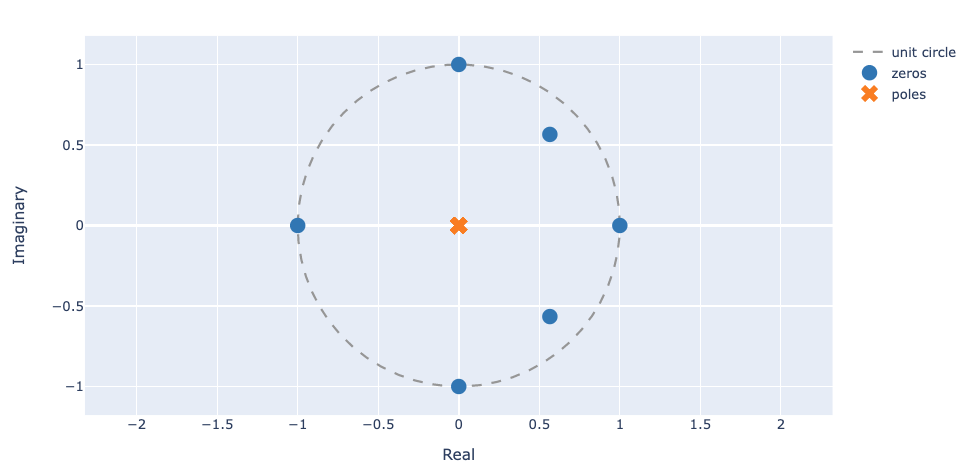
, zeros: ; and

1. Consider a cascade system as shown below



where the system function of the overall system is given as

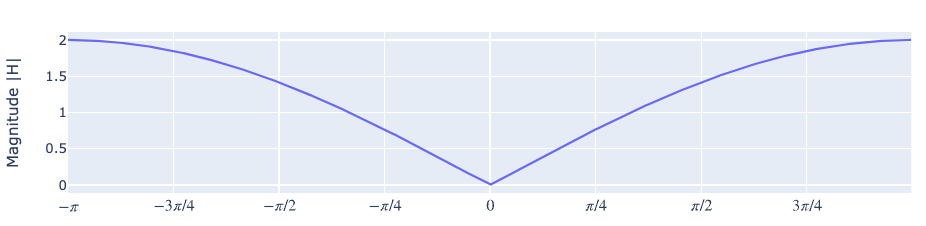
* 1. Determine the poles and zeros of and plot them in the complex *z*-plane.  
     **ANSWER**:   
     zeros:

poles: 0 (x6)  


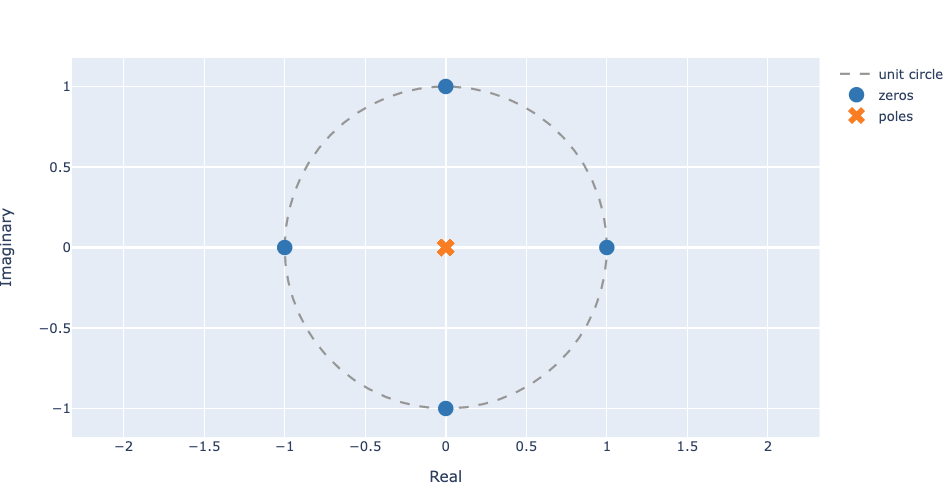
* 1. Find and such that the overall cascade system has the system function given above, and the output of the first system is given by .  
     **ANSWER**:
  2. Determine the difference equation that relates to for your answer in part (b).  
     **ANSWER**:

1. Suppose that a system is defined by
   1. Write the time-domain description of the system in the form of a difference equation.  
      **ANSWER**:
   2. Write the formula for the frequency response of the system.

**ANSWER**:

* 1. Sketch a plot of the magnitude response versus   
     **ANSWER**:  
     
  2. When the input to the system is determine the output signal   
     **ANSWER**:

1. An LTI system is described by
   1. Find its system function   
      **ANSWER**:
   2. Plot the poles and zeros of in the z-plane  
      **ANSWER**:   
      zeros:   
      poles: z = 0 (x4)



* 1. Find the frequency response and express it in polar form (magnitude and phase). Remember the “trik”   
     **ANSWER**:
  2. Sketch for <  
     **ANSWER**:   
     