1. (OS 2.23 a,b,c) + additional systems
   For each of the following systems, determine whether the system is (1) stable, (2) causal, (3) linear, and (4) time-invariant.
   (a) \( T(x[n]) = (\cos \pi n)x[n] \)
   (b) \( T(x[n]) = x[n^2] \)
   (c) \( T(x[n]) = x[n] \sum_{k=0}^{\infty} \delta[n-k] \)
   (d) \( T(x[n]) = e^{x[n]} \)
   (e) \( T(x[n]) = ax[n] + b \)

2. (OS 2.33)

3. (OS 2.47)

4. (OS 2.77)

5. For any \( 0 < N_1, N_2 < \infty \),
   (a) For \( a \neq 1 \), find a closed form expression for \( \sum_{n=N_1}^{N_2} a^n \)
   (b) For \( |a| < 1 \), find a closed form expression for \( \sum_{n=N_1}^{\infty} a^n \).

6. Given the two sequences
   \( x[n] = \left( -\frac{1}{2} \right)^n u[n-4] \)
   \( h[n] = 4^n u[2-n] \)
   (a) Use the convolution sum formula to find \( y[n] = h[n] \ast x[n] \).
   (b) Calculate the correlation between \( x[n] \) and \( h[n] \) where the correlation is defined as
   \( c_{xh}[l] = \sum_{k=-\infty}^{\infty} x[k]h[l+k] \).