Exercise 1

a) Compute the inverse of the following causal Z-Transform with the partial fraction method:

$$H(z) = \frac{7 + 1.7z^{-1} - 1.6z^{-2} + 0.028z^{-3}}{(1 - 0.04z^{-2}) \cdot (1 + 0.1z^{-1} - 0.2z^{-2})}.$$

b) Compute the first terms of the inverse of $H(z)$ with the long division method.

Solution

a) $h(n) = 3 \cdot (0.2)^n \cdot \mu(n) + 5 \cdot (-0.2)^n \cdot \mu(n) - 2 \cdot (-0.5)^n \cdot \mu(n) + (0.4)^n \cdot \mu(n)$.
b) $h(n) = \{7, 1, -0.02, 0.298, -0.0866, 0.0721, -0.026642, \ldots\}$.

Exercise 2

a) Compute the inverse of the following causal Z-Transform with the partial fraction method:

$$H(z) = \frac{-10 + 9.2z^{-1} - 3.1z^{-2}}{(1 - 0.8z^{-1} + 0.25z^{-2}) \cdot (1 - 0.5z^{-1})}.$$

b) Compute the first terms of the inverse of $H(z)$ with the long division method.

Solution

a) $h(n) = 2j \cdot (0.4 - 0.3j)^n \cdot \mu(n) - 2j \cdot (0.4 + 0.3j)^n \cdot \mu(n) - 10 \cdot (0.5)^n \cdot \mu(n) =$
$= 2 \cdot \text{ Re } (2j \cdot (0.4 - 0.3j)^n) \cdot \mu(n) - 10 \cdot (0.5)^n \cdot \mu(n) =$
$= 4 \cdot (0.5)^n \cdot \sin(nK) \cdot \mu(n) - 10 \cdot (0.5)^n \cdot \mu(n)$, with $K = \arctan\left(\frac{3}{4}\right)$.
b) $h(n) = \{-10, -3.8, -1.54, -0.782, -0.4906, -0.32198, \ldots\}$.

Exercise 3

a) Compute the inverse of the following causal Z-Transform with the partial fraction method:

$$H(z) = \frac{14 - 12.5z^{-1} + 3.3z^{-2} - 0.24z^{-3}}{(1 - 0.5z^{-1}) \cdot (1 + 0.2z^{-1}) \cdot (1 - 0.4z^{-1})^2}.$$

b) Compute the first terms of the inverse of $H(z)$ with the long division method.

Solution

a) $h(n) = 5 \cdot (0.5)^n \cdot \mu(n) + 6 \cdot (-0.2)^n \cdot \mu(n) + 2 \cdot (0.4)^n \cdot \mu(n) + (n + 1) \cdot (0.4)^n \cdot \mu(n)$.
b) $h(n) = \{14, 2.9, 2.29, 0.961, -0.5013, 0.23625, \ldots\}$.