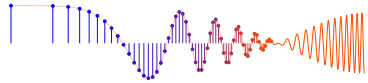


PROBLEM:

Pick the correct output signal and enter the number in the answer box:

Difference Equation, $H(z)$, $H(e^{j\hat{\omega}})$, or $h[n]$.

(a) $H(z) = \dfrac{100z^{-1} - 100}{1 - \frac{1}{3}z^{-1}}$

with $x[n] = u[n]$

ANS =

(b) $y[n] = \frac{1}{3}y[n-1] + 100x[n]$

with $x[n] = \cos(0.25\pi n)$

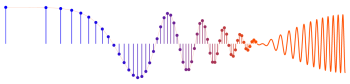
ANS =

Output Signal

1. $y[n] = 125\cos(0.25\pi n - 0.3)$
2. $y[n] = 100(\frac{1}{3})^{n-1}u[n-1]$
3. $y[n] = 100\delta[n-1] - 100\delta[n]$
4. $y[n] = -100(\frac{1}{3})^{n}u[n]$
5. $y[n] = 100(-\frac{1}{3})^{n}u[n]$
6. $y[n] = 125\cos(0.25\pi n + 0.3)$

McClellan, Schafer and Yoder, *Signal Processing First*, ISBN 0-13-065562-7.
Prentice Hall, Upper Saddle River, NJ 07458.

SOLUTION



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6. $y[n] = 125\cos(0.25\pi n + 0.3)$

(a) $H(z) = \dfrac{100z^{-1} - 100}{1 - \frac{1}{3}z^{-1}}$

with $x[n] = u[n]$

ANS = 4

$$Y(z) = H(z)X(z)$$

$$= \frac{100(z^{-1}-1)}{1-\frac{1}{3}z^{-1}} \cdot \frac{1}{1-z^{-1}}$$

$$= \frac{-100}{1-\frac{1}{3}z^{-1}}$$

Invert $y[n] = -100\left(\frac{1}{3}\right)^{n}u[n]$

(b) $y[n] = \frac{1}{3}y[n-1] + 100x[n]$

with $x[n] = \cos(0.25\pi n)$

$$H(z) = \frac{100}{1-\frac{1}{3}z^{-1}}$$

ANS = 1

Need to evaluate the frequency response at $\hat{\omega} = 0.25\pi$

$$H(e^{j\hat{\omega}})\Big|_{\hat{\omega}=0.25\pi} = \frac{100}{1-\frac{1}{3}e^{-j\pi/4}}$$

$$= 125\,e^{-j0.299} = -j0.095\pi$$

$$y[n] = 125\cos(0.25\pi n - 0.3)$$