Digital Signal Processing Sheet 1

Question 1: Find The Following Summations:

① $\sum_{n=-\infty}^{\infty} n^2 \delta(n+4)$

② $\sum_{n=0}^{\infty} \delta(n+1)\, 4^n$

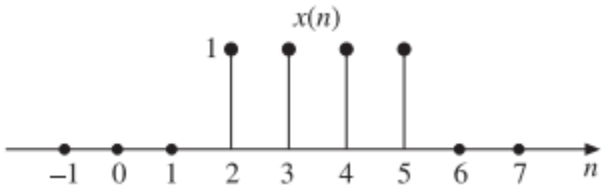
③ $\sum_{n=-\infty}^{\infty} \delta(n-2)\, e^{n^2}$

Question 2: Sketch The Following Signals:

① u(n+1) u(-n+4)

② x(n) = u(n+3) – u(n – 1)

Question 3: Express The Signal as the sum of singular functions:



Question 4:

Let $x(t)$ be the complex exponential signal, $x(t) = e^{j\omega_0 t}$ with radian frequency ω_0 and fundamental period $T = 2\pi/\omega_0$. Consider the discrete-time sequence $x(n)$ obtained by the uniform sampling of $x(t)$ with sampling interval T_s, i.e.,

$$x(n) = x(nT_s) = e^{jn\omega_0 T_s}$$

Show that $x(n)$ is periodic if the ratio of the sampling interval T_s to the fundamental period T of $x(t)$, i.e., T_s/T is a rational number.

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Question 5:

Determine whether the following discrete-time signals are periodic or not. If periodic, determine the fundamental period:

① $\sin(5\pi n)$

② $\cos 4n$

③ $\cos\left(\frac{n}{6}\right)\cos\left(\frac{n\pi}{6}\right)$

④ $\cos\left(\frac{\pi}{2}+0.3n\right)$

⑤ $1+e^{j2\pi n/3}-e^{j4\pi n/7}$