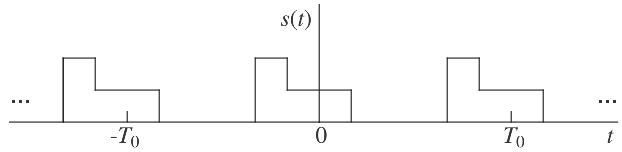
ENEE 222: 4/23 Class

1. The real-valued signal $s(t)$ shown below is periodic with period $T_0 = 2\pi/\Omega_0$.



Which (one or more) of the following equations is valid for $s(t)$?

A. $s[n] = \sum_{k=0}^{\infty} S_k e^{jk\Omega_0 t}$

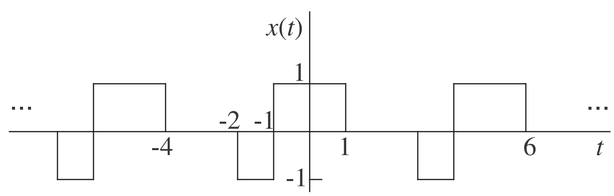
B. $s[n] = \sum_{k=0}^{\infty} A_k \cos(k\Omega_0 t + \phi_k)$

C. $s[n] = \sum_{k=0}^{\infty} A_k \cos(k\Omega_0 t)$

D. $s[n] = \sum_{k=0}^{M} A_k \cos(k\Omega_0 t + \phi_k)$ (where $M < \infty$)

2. The signal $x(t)$ depicted below is periodic with period $T_0 = 5$ seconds and has Fourier series expansion

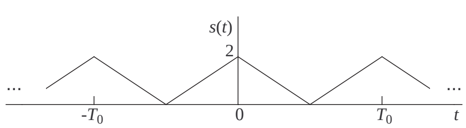
$$x(t) = \sum_{k=-\infty}^{\infty} X_k e^{jk\Omega_0 t}$$

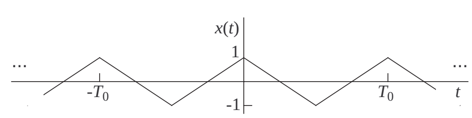


The value of X_0 equals

A. 0 B. 1/5 C. 3/5 D. 1

3. The signals $s(t)$ and $x(t)$ shown below are both periodic with period T_0.





If $\{S_k\}$ and $\{X_k\}$ are the corresponding (complex) Fourier series coefficients, which of the following statements is true?

A. $S_k = X_k$ for all indices k (in $\mathbf{Z}$).

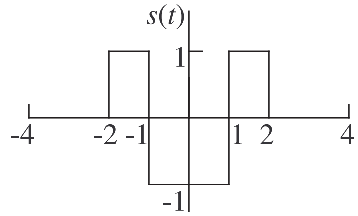
B. $S_k = X_k$ for all indices k but one.

C. $S_k = X_k$ only for finitely many indices k.

D. There exists no index k such that $S_k = X_k$.

4. Shown below is one period of

$$s(t) = \sum_{k=-\infty}^{\infty} S_k e^{jk\Omega_0 t}$$



Which of the following equations is correct?

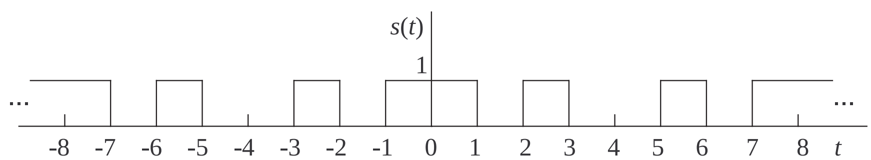
A. $S_k = \dfrac{\sin(k\pi/4) - \sin(k\pi/2)}{k\pi}$

B. $S_k = \dfrac{\sin(k\pi/4) - 2\sin(k\pi/2)}{k\pi}$

C. $S_k = \dfrac{\sin(k\pi/2) - \sin(k\pi/4)}{k\pi}$

D. $S_k = \dfrac{\sin(k\pi/2) - 2\sin(k\pi/4)}{k\pi}$

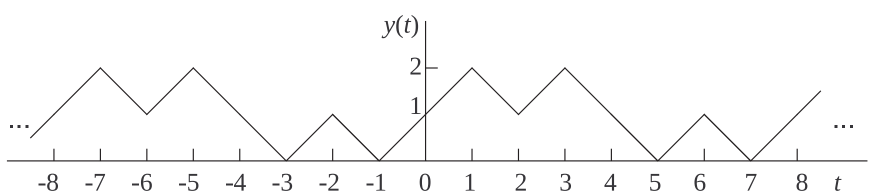
5. (HW 23 iii)



Sketch the periodic signal $x(t)$ which has period $T_0 = 8$ (i.e., same as $s(t)$) and complex Fourier series coefficients given by

$$X_k = \begin{cases} 0, & k = 0; \\ 2S_k, & k \neq 0. \end{cases}$$

6. (HW 23 v)



What is the relationship between $dy(t)/dt$ and $x(t)$ (found in **5** above)?

7. (HW 23 iv vi) If

$$x(t) = 2\sum_{k=1}^{\infty} A_k \cos(k\Omega_0 t) \qquad \text{and} \qquad y(t) = Y_0 + 2\sum_{k=1}^{\infty} B_k \sin(k\Omega_0 t) ,$$

evaluate Y_0 and express each B_k (where $k \geq 1$) in terms of A_k.