

6. Draw sketches and determine the Fourier Series...

Question

(0)

6. Draw sketches and determine the Fourier Series for the following functions.
- a. $s(x) = \frac{x}{\pi}$, for $-\pi < x < +\pi$

b. $s(x) = 3|\sin x|$ for $0 \leq x < 2\pi$

c. $s(x) = \begin{cases} 2\sin x & \text{for } 0 \leq x < \pi \\ 0 & \text{for } \pi \leq x < 2\pi \end{cases}$

d. $s(x) = \begin{cases} 1 & \text{for } 0 \leq x < \pi \\ 0 & \text{for } \pi \leq x < \pi \end{cases}$

e. $s(x) = A - \frac{Ax}{P}$ for $0 \leq x < P$

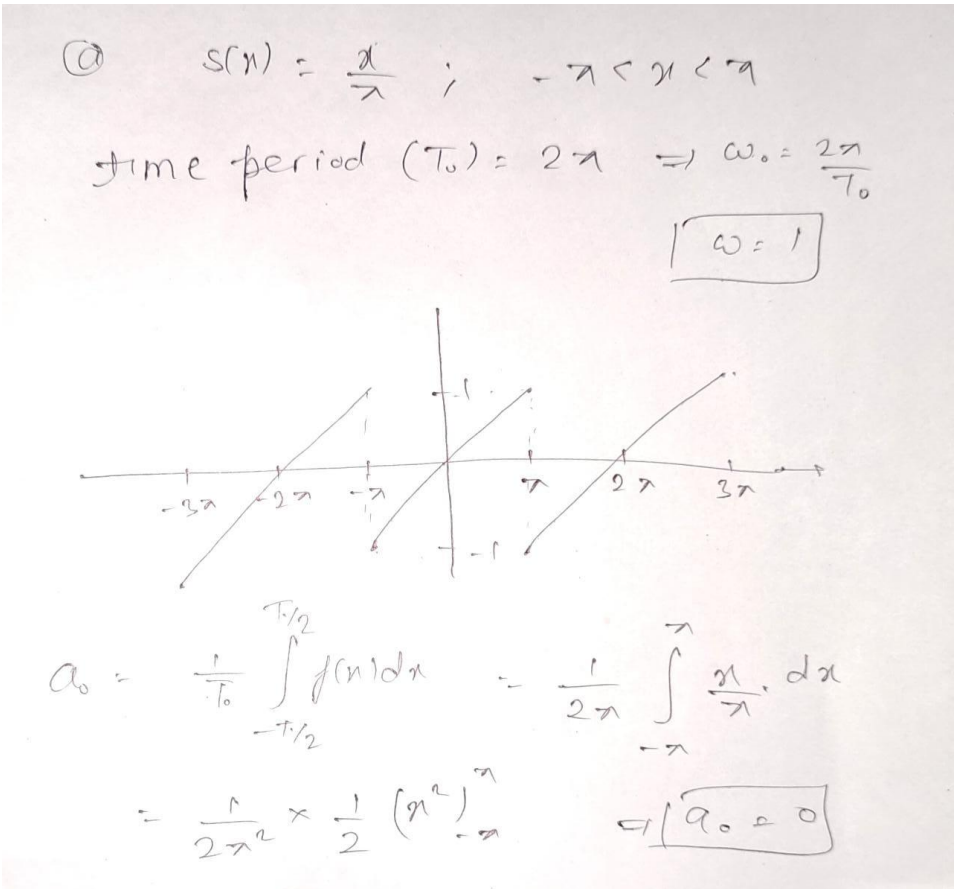
Expert Answer



This solution was written by a subject matter expert. It's designed to help students like you learn core concepts.

Step-by-step

- ⋮ 1st step
- ≡ All steps
- ✓ Answer only
- Step 1/2 ✓



use formula of fourier series coefficient to expand in fourier series.

Explanation:

use formula of fourier series coefficient to expand in fourier series.

Step 2/2 ✓

$$\begin{aligned}
 a_n &= \frac{2}{T} \int_{-T/2}^{T/2} f(x) \cos n \omega_0 x \, dx \\
 a_n &= \frac{1}{\pi} \int_{-\pi}^{\pi} \frac{x}{\pi} \cos nx \, dx \\
 a_n &= \frac{1}{\pi^2} \left[\frac{1}{n} (x \sin nx) \Big|_{-\pi}^{\pi} + \frac{1}{n^2} (\cos nx) \Big|_{-\pi}^{\pi} \right] \\
 \boxed{a_n} &= 0 \\
 b_n &= \frac{2}{T} \int_{-T/2}^{T/2} f(x) \sin n \omega_0 x \, dx \\
 b_n &= \frac{1}{\pi} \int_{-\pi}^{\pi} \frac{x}{\pi} \sin nx \, dx \\
 &= \frac{1}{\pi^2} \left[-\frac{1}{n} (x \cos nx) \Big|_{-\pi}^{\pi} + \frac{1}{n^2} (\sin nx) \Big|_{-\pi}^{\pi} \right] \\
 &= -\frac{1}{\pi^2} \left[\pi(-1)^n + \pi(-1)^n \right] \\
 &= -\frac{2(-1)^n}{\pi^2} = \frac{2(-1)^{n+1}}{\pi^2} \\
 f(x) &= a_0 + \sum_{n=1}^{\infty} a_n \cos n \omega_0 x + \sum_{n=1}^{\infty} b_n \sin n \omega_0 x \\
 \boxed{f(x)} &= \sum_{n=1}^{\infty} \frac{2(-1)^{n+1}}{\pi^2} \sin nx
 \end{aligned}$$

use formula of fourier series coefficient to expand in fourier series.

$$A_0 = \frac{1}{T} \int f(x) \, dx$$

$$A_n = \frac{2}{T} \int f(x) \cos(n \omega_0 x) \, dx$$

$$B_n = \frac{2}{T} \int f(x) \sin(n \omega_0 x) \, dx$$

Final answer✓

use formula of fourier series coefficient to expand in fourier series.

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