Expert Q&A

chegg.com/homework-help/questions-and-answers/1-periodic-function-provide-example-neat-sketch-determine-period-function-y-2023-sin-2022--q114294502

Question

(o)

1. What is a periodic Function? Provide an example with neat sketch. Determine the period of the function $y = 2023sin^{2022}11x + 12$
2. Define Odd and Even Function with figures. Provide example.
3. From the definition of Fourier Series $f(x) = a_0 + \sum_{n=1}^{\infty}(a_n cos\left(\frac{n\pi x}{L}\right) + b_n sin\left(\frac{n\pi x}{L}\right)$, which is period over the interval $[-L, +L]$, derive the formula for the coefficients a_0, a_n, b_n.
4. Using Euler's Identities, prove that the Fourier series can be expressed as $f(x) = \sum_{n=-\infty}^{+\infty} c_n e^{\frac{in\pi x}{L}}$
5. Define Orthogonal Functions. Using $\int_{-\pi}^{+\pi} sin\ nx\ dx = 0, and\ \int_{-\pi}^{+\pi} cos\ nx\ dx = 0, where\ m, n \in Z$, prove the following identities –
   a. $\int_{-\pi}^{\pi} \cos nx \cos mx\ dx = \begin{cases} 2\pi & \text{if } n = m = 0 \\ \pi & \text{if } n = m \neq 0 \\ 0 & \text{if } n \neq m \end{cases}$
   b. $\int_{0}^{\pi} \cos nx \cos mx\ dx = \begin{cases} \pi & \text{if } n = m = 0 \\ \frac{\pi}{2} & \text{if } n = m \neq 0 \\ 0 & \text{if } n \neq m \end{cases}$
   c. $\int_{-\pi}^{\pi} \sin nx \sin mx\ dx = \begin{cases} \pi & \text{if } n = m \\ 0 & \text{if } n \neq m \end{cases}$
   d. $\int_{0}^{\pi} \sin nx \sin mx\ dx = \begin{cases} \frac{\pi}{2} & \text{if } n = m \\ 0 & \text{if } n \neq m \end{cases}$
   e. $\int_{-\pi}^{\pi} \sin nx \cos mx\ dx = 0$
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 1/3

Multiple Question asked, from guidelines done first question for you.

To explain:

What is a periodic function, provide an example with a neat sketch and period of the function $y = 2{,}023\sin^{2{,}022}11x + 12$.

Explanation:

A period is the amount of time between two waves, whereas a periodic function is one whose values recur at regular intervals or periods.

Explanation:

The period of function $\sin^{n}(x)$ is the rtaio of period of sin xand 2, when n is even.

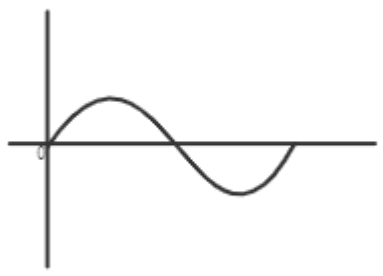
Step 2/3

Calculation:

The period of sin $x = 2\pi$ and the sketch of the period of sin x shown below:

The curve repeats its structure again after 2π, therefore the period of sin $x = 2\pi$.

Explanation:



The period of $y = a\sin(bx + c) + d$ is $\frac{2\pi}{a}$.

Step 3/3

The value of $n = 2{,}022$ for the function $y = 2{,}023\sin^{2{,}022}11x + 12$ is even.

The period of $\sin^{2{,}022}11x + 12$ is $\frac{2\pi}{11}$.

Therefore the period of the function $y = 2{,}023\sin^{2{,}022}11x + 12$ is,

$$P = \frac{\frac{2\pi}{11}}{2}$$

$$= \frac{\pi}{11}$$

Final answer

The period of the function $y = 2{,}023\sin^{2{,}022}11x + 12$ is $\frac{\pi}{11}$.

Was this answer helpful?

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