\[ f(x) = \left\{ \begin{array}{ll} x & \text{if } x \geq 3 \\ f(x+1) & \text{if } x < 3 \end{array} \right. \]

The function is defined piecewise with a recursive pattern. The graph shows the behavior of the function over its domain. The domain includes all real numbers, and the function repeats every three units. The function is not periodic in the traditional sense but rather possesses a kind of self-similarity. The graph illustrates the recursive nature of the function, with each segment of length three. The function appears to oscillate between linear and non-linear segments.
\[
\begin{align*}
\sin n \text{ and } \cos n x & \\
\text{Sum formulas with the function in } & \\
\text{standard form: } e^{ix} = \cos x + i \sin x & \\
\text{in exponential form:} & \\
\text{Sum formula with real functions:} & \\
\frac{d}{dx} \int_{0}^{\infty} f(x) \, dx = \frac{d}{dx} \left( \frac{1}{\nu} \int_{-\nu}^{\nu} f(x) \, dx \right) & \\
K_n = \frac{1}{2\pi \nu} & \\
\int_{-\infty}^{\infty} f(x) \, dx = \frac{1}{\nu} \int_{-\nu}^{\nu} f(x) \, dx & \\
\text{Formulas for } f(x) \text{ and } g(x) \text{ in } & \\
d= \text{functions independent on } f(x) \text{ at } \nu \text{ with} & \\
\text{and } \nu \text{ equal, change any function k constant and} & \\
\int_{-\infty}^{\infty} f_m(x) \, dx = \frac{1}{\nu} \int_{-\nu}^{\nu} f(x) \, dx & \\
\text{Summarize the result from the theorem:} & \\
\frac{1}{\nu} \int_{-\nu}^{\nu} f(x) \, dx = \int_{0}^{\infty} f(x) \, dx & \\
\text{and differ from only} & \\
\text{the Fourier coefficients of functions } f(x) & \
\end{align*}
\]
\( f(x) \) is symmetric and real for all \( n \geq 0 \) and \( b_n = 0 \).

For all \( n \neq 0 \):

\[
\begin{align*}
\hat{f}(n) &= \begin{cases} 1 & n = 0 \\
\frac{1}{|n|} & n \neq 0
\end{cases} \\
\hat{f}(-n) &= f(n)
\end{align*}
\]

So \( \hat{f}(-n) = \hat{f}(n) \) for all \( n \neq 0 \). This implies that \( f(x) \) is symmetric on the real axis.

\[
\int_{-\infty}^{\infty} x^n \sin(kx) \, dx = \pi \delta_{n,0} \sin(k) \quad \text{for } k \neq 0
\]

\[
\frac{7}{2} = \int_{-1}^{1} x^n \sin(x) \, dx = \frac{7}{2} \\
\Rightarrow \quad a_n = \begin{cases} 0 & n \neq 0 \\
\frac{7}{2} & n = 0
\end{cases}
\]

\[
\begin{align*}
\sum_{n=0}^{\infty} a_n \cos(kx) + b_n \sin(kx) &= f(x) \\
b_n &= \begin{cases} 0 & n \neq 0 \\
\frac{7}{2} & n = 0
\end{cases}
\end{align*}
\]

\[
\sum_{n=0}^{\infty} a_n \cos(kx) + \sum_{n=0}^{\infty} b_n \sin(kx) = f(x)
\]

From the Fourier series formula.

- 5.3 -
\[
\frac{\partial}{\partial t} \frac{\partial C}{\partial x} = \frac{\partial^2 C}{\partial x^2}
\]

\[
0 \leq x \leq L
\]

\[
0 \leq t \leq \infty
\]