Warm-Up for March 4th, 2022

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1 Memory Bank

1. The **Fourier series** representation of a function $f(x)$ is written:

$$S(x) = \frac{A_0}{2} + \sum_{i=1}^{\infty} \left(A_n \cos(nx) + B_n \sin(nx) \right) \tag{1}$$

with

$$A_n = \frac{1}{\pi} \int_0^{2\pi} f(x) \cos(nx) dx \tag{2}$$

$$B_n = \frac{1}{\pi} \int_0^{2\pi} f(x) \sin(nx) dx \tag{3}$$

2 Representing a Solution with a Fourier Series

Suppose we have an arrangement of charge such that we can create a *periodic* potential:

$$f(x) = x, \quad 0 \leq x \leq 2\pi \tag{4}$$

Between 2π and 4π, $f(x) = (x - 2\pi)$, etc., so that the function repeats. (a) Use the formulas in the memory bank to determine A_n and B_n. (b) Can you graph the series and the function together, to see if they match?