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 Quiz 427J

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1. Find the Sine Series for

$$f(x) = -1 \text{ on domain } 0 < x < \pi$$

Include the first four nonzero terms. Make sure your coefficients are simplified fractions with no trigonometric expressions and no decimal expressions.

$$\Rightarrow -1 \equiv \sum_{n=1}^{\infty} b_n \sin\left(\frac{n\pi x}{\pi}\right), \quad 0 < x < \pi$$

$$\Rightarrow b_n = \frac{2}{\pi} \int_0^{\pi} (-1) \sin(nx) dx$$

$$= -\frac{2}{\pi} \int_0^{\pi} \sin(nx) dx = \left[\frac{2}{n\pi} \cos(nx) \right]_0^{\pi}$$

$$= \frac{2}{n\pi} \cos(n\pi) - \frac{2}{n\pi} \cos(0)$$

$$\equiv \frac{2}{n\pi} (\cos(n\pi) - 1) \equiv \frac{2}{n\pi} ((-1)^n - 1)$$

$$\therefore -1 \equiv \sum_{n=1}^{\infty} \frac{2}{n\pi} ((-1)^n - 1) \sin(nx)$$

$$b_1 = -\frac{4}{\pi}$$

$$b_2 = 0$$

$$b_3 = -\frac{4}{3\pi}$$

$$b_4 = 0$$

$$b_5 = -\frac{4}{5\pi}$$

$$b_6 = 0$$

$$b_7 = -\frac{4}{7\pi}$$

$$\therefore -1 \equiv -\frac{4}{\pi} \sin(x) - \frac{4}{3\pi} \sin(3x) - \frac{4}{5\pi} \sin(5x) - \frac{4}{7\pi} \sin(7x) - \dots$$