

b) Express $f(x) = x$ as a half range cosine series in $0 < x < 2$.

$$\text{Sol}^n \quad f(x) = \frac{a_0}{2} + \sum_{n=1}^{\infty} \frac{a_n \cos n\pi x}{L}$$

$$L = 2$$

$$a_0 = \frac{2}{L} \int_0^L f(x) dx$$

$$= \frac{2}{2} \int_0^2 x dx = \left[\frac{x^2}{2} \right]_0^2 = 2 \quad \Rightarrow a_0 = 2$$

$$a_n = \frac{2}{L} \int_0^L f(x) \frac{\cos n\pi x}{L} dx$$

$$= \frac{2}{2} \int_0^2 x \frac{\cos n\pi x}{2} dx$$

$$= \left[\frac{x \sin n\pi x / 2}{n\pi / 2} - \frac{1 \left(-\cos n\pi x / 2 \right)}{(n\pi / 2)^2} \right]_0^2$$

$$a_n = \frac{4}{n^2 \pi^2} ((-1)^n - 1)$$

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Required half range cosine series,

$$f(x) = 1 + \sum_{n=1}^{\infty} \frac{4}{n^2 \pi^2} ((-1)^n - 1) \cos n\pi x$$