$$f(t) = t \qquad -2\pi < t \leq 2\pi$$

$$a_0 = \frac{1}{L}\int_{-L}^{L} t \cdot dt = \frac{1}{2\pi}\int_{-2\pi}^{2\pi} t \, dt$$

$$= \frac{1}{2\pi} \; t^2 \Big|_{-2\pi}^{2\pi}$$

$$= \frac{1}{2\pi}(4\pi - 4\pi) = 0$$

$$a_n = \frac{1}{L}\int_{-L}^{L} f(t)\cos\left(\frac{n\pi}{L} t\right) dt$$

$$= \frac{1}{2\pi}\int_{-2\pi}^{2\pi} \underset{u}{t} \; \underset{dv}{\cos\left(\frac{n}{2} t\right) dt}$$

$$= \frac{1}{2\pi}\left(t \cdot \sin\left(\frac{n}{2}t\right) \cdot \frac{2}{n} \Big|_{-2\pi}^{2\pi} - \int_{-2\pi}^{2\pi} \frac{2}{n} \sin\left(\frac{n}{2}t\right) dt\right.$$

$$= \frac{1}{2\pi}\left(2\pi \cdot \sin(\pi t) \cdot \frac{2}{n} - (-2\pi \sin(-\pi t)\right)\frac{2}{n}$$

integral

$= 0 \leftarrow$ of odd function)

$= \frac{1}{2\pi}\left(\frac{4\pi}{n}\left[\sin(\pi t) - \sin(\pi t)\right]\right)$ ← sine is odd

$= 0$

$$b_n = \frac{1}{L}\int_{-L}^{L} f(t)\sin\left(\frac{n\pi t}{L}\right)dt$$

$$= \frac{1}{L}\int_{-L}^{L} t\sin\left(\frac{\pi n t}{L}\right)dt$$

$$= \frac{1}{2\pi}\int_{-2\pi}^{2\pi} t\sin\left(\frac{\pi n t}{2\pi}\right)dt$$

$$= \frac{1}{2\pi}\left(-t\cdot\cos\left(\frac{\pi n t}{2\pi}\right)\cdot\frac{2}{n}\Big|_{-2\pi}^{2\pi} + \int_{-2\pi}^{2\pi}\frac{2}{n}\cdot\cos\left(\frac{\pi n t}{2\pi}\right)dt\right)$$

$$= \frac{1}{2\pi}\left(-2\pi\cos(n\pi)\cdot\frac{2}{n} - \left(2\pi\cos(-n\pi)\cdot\frac{2}{n}\right) + \frac{4}{n}\sin(nt)\Big|_{-2\pi}^{2\pi}\right.$$

$$= \frac{1}{2\pi}\left(\frac{-8\pi}{n}\cos(n\pi) + \frac{4}{n}\left(\sin(2\pi n) - \sin(-2\pi n)\right)\right)$$

$$= \frac{1}{2\pi}\left(\frac{-8\pi}{n}\cos(n\pi) + \cancel{\frac{8}{n}\sin(2\pi n)}\right)$$

$$= \frac{1}{2\pi}\left(\frac{-8\pi}{n}(-1)^n\right)$$

$$= \frac{4}{n}(-1)^{n+1}$$

$$f(t) = g\left(\frac{t n\pi}{2\pi}\right) = \sum_{n=1}^{\infty} \frac{4}{n}(-1)^{n+1}\sin\left(\frac{t\pi}{2\pi}\right)$$

$$= \sum_{n=1}^{\infty} \frac{4}{n}(-1)^{n+1}\sin(nt/2)$$