$\boxed{7\text{-}5.7}$

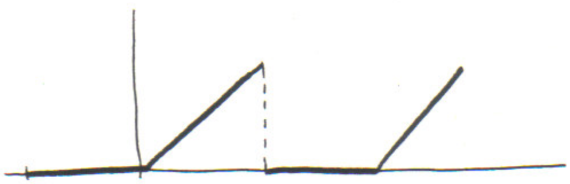
$f(x) = 0 \quad -\pi < x \le 0$ $\qquad 2\ell = 2\pi$

$f(x) = x \quad 0 \le x < \pi$

$$a_0 = \frac{1}{\pi}\int_0^{2\pi} f(x)\,dx = \frac{1}{\pi}\left[\int_{-\pi}^{\pi} f(x)\,dx + \int_0^{\pi} f(x)\,dx\right]$$

$$a_0 = 0 + \frac{1}{\pi}\int_0^{\pi} x\,dx = \frac{1}{\pi}\left[\tfrac{1}{2}x^2\right]_0^{\pi}$$

$$a_0 = \frac{1}{2\pi}(\pi^2 - 0) = \frac{\pi}{2}$$



$-\pi \qquad \pi$

$$a_n = \frac{1}{\pi}\int_0^{\pi} x\cos nx\,dx = \frac{1}{\pi}\left[\frac{1}{n^2}\cos nx + \frac{x}{n}\sin nx\right]_0^{\pi}$$

$$= \frac{1}{\pi}\left[\left(\frac{1}{n^2}\cos n\pi + \frac{\pi}{n}\underbrace{\sin n\pi}_{=0}\right) - \left(\frac{1}{n^2}\underbrace{\cos n0}_{=1} + 0\right)\right] = \frac{1}{\pi}\left[\frac{1}{n^2}(\cos n\pi - 1)\right]$$

$$= \frac{1}{\pi}\left[\left(\frac{1}{n^2}\left(\pm 1 \ {}^{n\ \text{even}}_{\text{odd}}\right) + 0\right) - \left(\frac{1}{n^2}\right)\right] = \frac{1}{\pi n^2}[\pm 1 - 1]$$

$$\boxed{a_n = \frac{-2}{\pi n^2} \quad \text{for } n \text{ odd}}\ \text{e.g.}\ -\frac{2}{\pi},\ \frac{-2}{9\pi},\ \frac{-2}{25\pi}\ \text{etc.}$$

$$\boxed{a_n = 0 \quad \text{for } n \text{ even}}$$

$$b_n = \frac{1}{\pi}\int_0^{2\pi} x\sin nx\,dx = \frac{1}{\pi}\left[\frac{1}{n^2}(\sin nx) - \frac{x}{n}\cos nx\right]_0^{\pi}$$

$$= \frac{1}{\pi}\left[\frac{1}{n^2}\underbrace{(\sin n\pi)}_{=0} - \frac{\pi}{n}\cos n\pi - 0 + 0\right] = -\frac{1}{n}\cos n\pi$$

$$b_n = \pm\frac{1}{n}\left\{\begin{matrix} n & \text{even} \\ n & \text{odd}\end{matrix}\right\} \quad \frac{1}{n}(-1)^{n+1}$$

Hence

$$f(x) = \frac{\pi}{4} - \frac{2}{\pi}\left(\cos x + \frac{\cos 3x}{9} + \frac{\cos 5x}{25} + \right) + \left(\sin x - \frac{\sin 2x}{2} + \frac{\sin 3x}{3} - \frac{\sin 4x}{4} + \quad\right)$$

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