II) $a_0 = \frac{1}{\pi}\int_{-\pi}^{\pi} x^2\,dx = \frac{1}{\pi}\left[\frac{1}{3}x^3\right]_{-\pi}^{\pi} = \frac{1}{\pi}\left[\frac{1}{3}\pi^3 + \frac{1}{3}\pi^3\right] = \frac{2}{3}\pi^2$

$$a_k = \frac{1}{\pi}\int_{-\pi}^{\pi} x^2 \cos kx\,dx = \frac{1}{\pi}\left(\left[\frac{x^2}{k}\sin kx\right]_{-\pi}^{\pi} - \int \frac{2x}{k}\sin kx\,dx\right)$$

$$= \frac{1}{\pi}\left(\frac{\pi^2}{k}\sin k\pi - \frac{\pi^2}{k}\sin(-k\pi) - \left[\frac{-2x}{k^2}\cos kx\right]_{-\pi}^{\pi} - \int_{-\pi}^{\pi}\frac{2}{k^2}\cos kx\,dx\right)$$

$$= \frac{1}{\pi}\left(0 - 0 + \frac{2\pi}{k^2}\cos k\pi + \frac{2\pi}{k^2}\cos(-k\pi) - \left[\frac{2}{k^3}\sin kx\right]_{-\pi}^{\pi}\right)$$

$$= \frac{1}{\pi}\left(\frac{4\pi\cos k\pi}{k^2} - \frac{2}{k^3}\sin k\pi + \frac{2}{k^3}\sin(-k\pi)\right)$$

$$= \frac{4}{k^2}\cos k\pi = \frac{4}{k^2}(-1)^k$$

$$b_k = \frac{1}{\pi}\int_{-\pi}^{\pi} x^2 \sin kx\,dx = \frac{1}{\pi}\left(\left[-\frac{x^2}{k}\cos kx\right]_{-\pi}^{\pi} - \int_{-\pi}^{\pi} -\frac{2x}{k}\cos kx\,dx\right)$$

$$= \frac{1}{\pi}\left(-\frac{\pi^2}{k}\cos k\pi + \frac{\pi^2}{k}\cos(-k\pi) + \left[\frac{2x}{k^2}\sin kx\right]_{-\pi}^{\pi} - \int_{-\pi}^{\pi}\frac{2}{k^2}\sin kx\,dx\right)$$

$$= \frac{1}{\pi}\left(-\frac{\pi^2}{k}\cos(k\pi) + \frac{\pi^2}{k}\cos(k\pi) + \frac{2\pi}{k^2}\sin k\pi + \frac{2\pi}{k^2}\sin(-k\pi) + \left[\frac{2}{k^3}\cos kx\right]_{-\pi}^{\pi}\right)$$

$$= \frac{1}{\pi}\left(0 + 0 + 0 + \frac{2}{k^3}\cos(k\pi) - \frac{2}{k^3}\cos(-k\pi)\right)$$

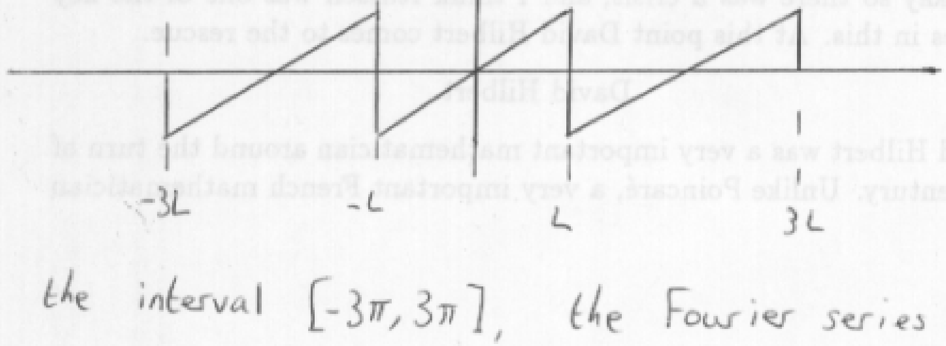
$$= \frac{1}{\pi}\left(\frac{2}{k^3}\cos(k\pi) - \frac{2}{k^3}\cos(+k\pi)\right) = 0.$$

so $F(x) = \frac{1}{3}\pi^3 + \sum_{n=1}^{\infty}\frac{4}{n^2}(-1)^n \cos nx$

Note that in (II) we have returned to the previous definition of the Fourier series $\left(F(x) = \frac{a_0}{2} + \sum_{n=1}^{\infty} a_n \cos nx + \sum_{n=1}^{\infty} b_n \sin nx\right)$ because the interval on which we are given $F(x)$ is $[-\pi, \pi]$.

In the interval $[-3L, 3L]$, the Fourier series of (I) looks exactly the same as $F(x)$, only repeated three times and with the ends joined up.

$\sum_{n=1}^{\infty}\frac{2L}{n\pi}(-1)^{n+1}\sin\frac{n\pi x}{L}$ looks like



In the interval $[-3\pi, 3\pi]$, the Fourier series of (II) looks like