$$f(x) = a_0 + \sum_{n=1}^{\infty}\left[a_n \cos(n\pi x) + b_n \sin(n\pi x)\right]$$

$$a_0 = \frac{1}{2L}\int_0^{2L} f(x)dx = \frac{1}{2}$$

$$a_n = \frac{1}{L}\int_0^{2L} f(x)\cos(\frac{n\pi x}{L})dx = \frac{-2(-1+\cos(n\pi))}{n^2\pi^2}$$

$$b_n = \frac{1}{L}\int_0^{2L} f(x)\sin(\frac{n\pi x}{L})dx = \frac{2(n\pi - \sin(n\pi))}{n^2\pi^2} = \frac{2}{n\pi}$$

$f(0) = 1$ (converge in the mean)

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

$$1/2 = \sum_{n=1}^{\infty} \frac{-2(-1+(-1)^n)}{n^2\pi^2} = \sum_{n=1}^{\infty} \frac{-2(-1+(-1)^n)}{n^2\pi^2} = \sum_{k=0}^{\infty} \frac{4}{(2k+1)^2\pi^2}$$

$$\pi^2/2 = \sum_{n=1}^{\infty} \frac{-2(-1+(-1)^n)}{n^2\pi^2} = \sum_{n=1}^{\infty} \frac{-2(-1+(-1)^n)}{n^2\pi^2} = \sum_{k=0}^{\infty} \frac{4}{(2k+1)^2}$$