Fourier Series representation of $f(x)$

For $f(x)$ defined on $x \in [-L, L]$

$$f(x) \approx \frac{a_0}{2} + \sum_{n=1}^{\infty} a_n \cos(\omega_n x) + \sum_{n=1}^{\infty} b_n \sin(\omega_n x) \qquad \omega_n = n\frac{\pi}{L}$$

$$a_n = \langle f(x), \cos(\omega_n x) \rangle = \frac{1}{L} \int_{-L}^{L} f(x) \cdot \cos(\omega_n x) dx$$

$$b_n = \langle f(x), \sin(\omega_n x) \rangle = \frac{1}{L} \int_{-L}^{L} f(x) \cdot \sin(\omega_n x) dx$$