The following integrals may be useful when computing Fourier series.

$$\int x\sin(x)dx = \sin(x) - x\ \cos(x);$$

$$\int x^n \sin(x)dx = -x^n \cos(x) + n \cdot \int x^{n-1} \cos(x)dx$$

$$\int x\cos(x)dx = \cos(x) + x\ \sin(x);$$

$$\int x^n \cos(x)dx = x^n \sin(x) - n \cdot \int x^{n-1} sin(x)dx$$

$$\int e^{ax}\sin(nx)dx = e^{ax}\left(\frac{a\sin(nx) - n\cos(nx)}{a^2+n^2}\right)$$

$$\int e^{ax}\cos(nx)dx = e^{ax}\left(\frac{a\cos(nx) + n\sin(nx)}{a^2+n^2}\right).$$

The following three formulas hold if $a \neq \pm b$:

$$\int \sin(ax)\sin(bx)dx = -\frac{\sin((a+b)x)}{2(a+b)} + \frac{\sin((a-b)x)}{2(a-b)}$$

$$\int \cos(ax)\cos(bx)dx = \frac{\sin((a+b)x)}{2(a+b)} + \frac{\sin((a-b)x)}{2(a-b)}$$

$$\int \sin(ax)\cos(bx)dx = -\frac{\cos((a+b)x)}{2(a+b)} - \frac{\cos((a-b)x)}{2(a-b)}.$$