Integral Cheat Sheet

$$\int_a^b x\sin\left(\frac{n\pi x}{\ell}\right)dx = \left[-\frac{\ell x\cos\left(\frac{n\pi x}{\ell}\right)}{n\pi} + \frac{\ell^2\sin\left(\frac{n\pi x}{\ell}\right)}{n^2\pi^2}\right]\Bigg|_a^b$$

$$\int_a^b x^2\sin\left(\frac{n\pi x}{\ell}\right)dx = \frac{\ell}{n^3\pi^3}\left[(2\ell^2 - n^2\pi^2x^2)\cos\left(\frac{n\pi x}{\ell}\right) + 2\ell n\pi x\sin\left(\frac{n\pi x}{\ell}\right)\right]\Bigg|_a^b$$

$$\int_a^b x^3\sin\left(\frac{n\pi x}{\ell}\right)dx = \frac{\ell}{n^4\pi^4}\left[(6\ell^2 n\pi x - n^3\pi^3x^3)\cos\left(\frac{n\pi x}{\ell}\right) + 3\ell(-2\ell^2 + n^2\pi^2x^2\sin\left(\frac{n\pi x}{\ell}\right)\right]\Bigg|_a^b$$

$$\int_a^b x\cos\left(\frac{n\pi x}{\ell}\right)dx = \left[\frac{\ell^2\cos\left(\frac{n\pi x}{\ell}\right)}{n^2\pi^2} + \frac{\ell x\sin\left(\frac{n\pi x}{\ell}\right)}{n\pi}\right]\Bigg|_a^b$$

$$\int_a^b x^2\cos\left(\frac{n\pi x}{\ell}\right)dx = \frac{\ell}{n^3\pi^3}\left[2\ell n\pi x\cos\left(\frac{n\pi x}{\ell}\right) + \left(-2\ell^2 + n^2\pi^2x^2\right)\sin\left(\frac{n\pi x}{\ell}\right)\right]\Bigg|_a^b$$

$$\int_a^b x^3\cos\left(\frac{n\pi x}{\ell}\right)dx = \frac{\ell}{n^4\pi^4}\left[(-6\ell^3 + 3\ell n^2\pi^2x^2)\cos\left(\frac{n\pi x}{\ell}\right) + n\pi x(-6\ell^2 + n^2\pi^2x^2)\sin\left(\frac{n\pi x}{\ell}\right)\right]\Bigg|_a^b$$

$$\int_a^b e^x\sin\left(\frac{n\pi x}{\ell}\right)dx = \left[\frac{e^x\ell\left(-n\pi\cos\left(\frac{n\pi x}{\ell}\right) + \ell\sin\left(\frac{n\pi x}{\ell}\right)\right)}{\ell^2 + n^2\pi^2}\right]\Bigg|_a^b$$

$$\int_a^b e^x\cos\left(\frac{n\pi x}{\ell}\right)dx = \left[\frac{e^x\ell\left(\ell\cos\left(\frac{n\pi x}{\ell}\right) + n\pi\sin\left(\frac{n\pi x}{\ell}\right)\right)}{\ell^2 + n^2\pi^2}\right]\Bigg|_a^b$$

$$\int_a^b \sin(x)\cos(nx)\,dx = \left[\frac{\cos(x)\cos(nx) + n\sin(x)\sin(nx)}{n^2 - 1}\right]\Bigg|_a^b$$

$$\int_a^b \cos(x)\cos(nx)\,dx = \left[\frac{-\sin(x)\cos(nx) + n\cos(x)\sin(nx)}{n^2 - 1}\right]\Bigg|_a^b$$

$$\int_a^b \sin(x)\sin(nx)\,dx = \left[\frac{-n\sin(x)\cos(nx) + \cos(x)\sin(nx)}{n^2 - 1}\right]\Bigg|_a^b$$

$$\int_a^b \cos(x)\sin(nx)\,dx = \left[\frac{n\cos(x)\cos(nx) + \sin(x)\sin(nx)}{1 - n^2}\right]\Bigg|_a^b$$

$$\int_0^\infty e^{\alpha x^2}\sin(\beta x)\,dx = 0$$

$$\int_0^\infty e^{\alpha x^2}\cos(\beta x)\,dx = \frac{\sqrt{\pi}}{2\sqrt{\alpha}}e^{-\frac{\beta^2}{4\alpha}}$$

$$\int_0^\infty e^{-u^2}\,du = \frac{\sqrt{\pi}}{2}$$