Fourier Transform Properties

1. $\hat{f}(\lambda) = \mathcal{F}[f](\lambda) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} f(x) e^{-ix\lambda} dx.$
2. $\frac{f(x^+) + f(x^-)}{2} = \mathcal{F}^{-1}[\hat{f}](x) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} \hat{f}(\lambda) e^{ix\lambda} d\lambda.$
3. $\mathcal{F}[x^n f(x)](\lambda) = i^n \hat{f}^{(n)}(\lambda).$
4. $\mathcal{F}[f^{(n)}(x)](\lambda) = (i\lambda)^n \hat{f}(\lambda).$
5. $\mathcal{F}[f(x-a)](\lambda) = e^{-i\lambda a} \hat{f}(\lambda).$
6. $\mathcal{F}[f(bx)](\lambda) = \frac{1}{b} \hat{f}(\frac{\lambda}{b}).$

Integrals

1. $\int e^{at} dt = \frac{1}{a} e^{at} + C$
2. $\int t^n e^{at} dt = \frac{1}{a} t^n e^{at} - \frac{n}{a} \int t^{n-1} e^{at} dt$
3. $\int t \sin(t) dt = \sin(t) - t \cos(t) + C$
4. $\int t \cos(t) dt = \cos(t) + t \sin(t) + C$
5. $\int e^{at} \cos(bt) dt = \frac{e^{at}}{a^2 + b^2} (a \cos(bt) + b \sin(bt)) + C$
6. $\int e^{at} \sin(bt) dt = \frac{e^{at}}{a^2 + b^2} (a \sin(bt) - b \cos(bt)) + C$
7. $\int \cos(at) \cos(bt) dt = \frac{\sin((a+b)t)}{2(a+b)} + \frac{\sin((a-b)t)}{2(a-b)} + C, \ a \neq b$
8. $\int \sin(at) \sin(bt) dt = \frac{\sin((a+b)t)}{2(a+b)} - \frac{\sin((a-b)t)}{2(a-b)} + C, \ a \neq b$
9. $\int \sin(at) \cos(bt) dt = -\frac{\cos((a+b)t)}{2(a+b)} - \frac{\cos((a-b)t)}{2(a-b)} + C, \ a \neq b$