Property	***Signal***	***Fourier Transform***
	$x(t) = \int_{-\infty}^{\infty} X(f)\mathrm{e}^{j2\pi ft}\mathrm{d}f$ $y(t) = \int_{-\infty}^{\infty} Y(f)\mathrm{e}^{j2\pi ft}\mathrm{d}f$	$X(f) = \int_{-\infty}^{\infty} x(t)\mathrm{e}^{-j2\pi ft}\mathrm{d}t$ $Y(f) = \int_{-\infty}^{\infty} y(t)\mathrm{e}^{-j2\pi ft}\mathrm{d}t$
Linearity	$Ax(t) + By(t)$	$AX(f) + BY(f)$
Time Shift	$x(t - t_0)$	$\mathrm{e}^{-j2\pi ft_0}X(f)$
Frequency Shift	$\mathrm{e}^{j2\pi f_0 t}x(t)$	$X(f - f_0)$
Scaling	$x(at)$	$\frac{1}{\lvert a\rvert}X\left(\frac{f}{a}\right)$
Duality	$X(t)$	$x(-f)$
Complex Conjugate	$x^*(t)$	$X^*(-f)$
Area	$\mathrm{X}(0) = \int_{-\infty}^{\infty} x(t)\mathrm{d}t$	
	$x(0) = \int_{-\infty}^{\infty} X(f)\mathrm{d}f$	
Time Differentiation	$x^{'}(t)$ $\frac{\mathrm{d}^n x(t)}{\mathrm{d}t^n}$	$\mathrm{j}2\pi fX(f)$ $(j2\pi f)^n X(f)$
Freq. Differentiation	$-j2\pi tx(t)$ $(-j2\pi t)^n x(t)$	$X^{'}(f)$ $\frac{\mathrm{d}^n X(f)}{\mathrm{d}f^n}$
Time Integration	$\int_{-\infty}^{t} x(\tau)\mathrm{d}\tau$	$\frac{1}{j2\pi f}X(f),\ \text{for } X(0) = 0$
Convolution	$\int_{-\infty}^{\infty} x(\tau)y(t-\tau)\mathrm{d}\tau$	$X(f)Y(f)$
Multiplication	$x(t)y(t)$	$\int_{-\infty}^{\infty} X(\nu)Y(f-\nu)\mathrm{d}\nu$
Energy Conservation (Parseval's Theorem)	$\int_{-\infty}^{\infty} \lvert x(t)\rvert^2\mathrm{d}t = \int_{-\infty}^{\infty} \lvert X(f)\rvert^2\mathrm{d}f$	

Figure 4.1: Properties of the Fourier Transform

	$g(t)$	$G(f)$	
	$e^{-at}u(t)$	$\frac{1}{a+j2\pi f}$	$a>0$
2	$e^{at}u(-t)$	$\frac{1}{a-j2\pi f}$	$a>0$
3	$e^{-a\lvert t\rvert}$	$\frac{2a}{a^2+(2\pi f)^2}$	
4	$te^{-at}u(t)$	$\frac{1}{(a+j2\pi f)^2}$	$a>0$
5	$t^n e^{-at}u(t)$	$\frac{n!}{(a+j2\pi f)^{n+1}}$	
6	$\delta(t)$	1	
7	1	$\delta(f)$	
8	$e^{j2\pi f_0 t}$	$\delta(f-f_0)$	
9	$\cos 2\pi f_0 t$	$0.5\,[\delta(f+f_0)+\delta(f-f_0)]$	
10	$\sin 2\pi f_0 t$	$j0.5\,[\delta(f+f_0)-\delta(f-f_0)]$	
11	$u(t)$	$\frac{1}{2}\delta(f)+\frac{1}{j2\pi f}$	
12	$\operatorname{sgn} t$	$\frac{2}{j2\pi f}$	
	$\cos 2\pi f_0 t\,u(t)$	$\frac{1}{4}[\delta(f-f_0)+\delta(f+f_0)]+\frac{j2\pi f}{(2\pi f_0)^2-(2\pi f)^2}$	
14	$\sin 2\pi f_0 t\,u(t)$	$\frac{1}{4j}[\delta(f-f_0)-\delta(f+f_0)]+\frac{2\pi f_0}{(2\pi f_0)^2-(2\pi f)^2}$	
15	$e^{-at}\sin 2\pi f_0 t\,u(t)$	$\frac{2\pi f_0}{(a+j2\pi f)^2+4\pi^2 f_0^2}$	
16	$e^{-at}\cos 2\pi f_0 t\,u(t)$	$\frac{a+j2\pi f}{(a+j2\pi f)^2+4\pi^2 f_0^2}$	
	$\operatorname{rect}\left(\frac{t}{\tau}\right)$	$\tau\cdot\operatorname{sinc}(f\tau)$	
18	$\operatorname{sinc}(2Bt)$	$\frac{1}{2B}\operatorname{rect}\left(\frac{t}{2B}\right)$	
19	$\tau\operatorname{tri}\left(\frac{t}{\tau}\right)$	$\tau^2\operatorname{sinc}^2(f\tau)$	
20	$\operatorname{sinc}^2(2Bt)$	$\frac{1}{2B}\operatorname{tri}\left(\frac{f}{2B}\right)$	
21	$\sum_{n=-\infty}^{\infty}\delta(t-nT)$	$f_0\sum_{n=-\infty}^{\infty}\delta(f-nf_0)$	
22	$e^{-t^2/2\sigma^2}$	$\sigma\sqrt{2\pi}e^{-2(\sigma\pi f)^2}$	

Figure 4.2: Table of the Fourier Transform