Fourier Transform

$$\hat{f}(\alpha) = \int_{-\infty}^{\infty} f(t)\, e^{-i\alpha t}\, dt$$

$$f(t) = \frac{1}{2\pi} \int_{-\infty}^{\infty} \hat{f}(\alpha)\, e^{i\alpha t}\, d\alpha$$

Properties:

$f(t)$	$\hat{f}(\alpha)$
$f(at)$	$\frac{1}{a}\hat{f}\left(\frac{\alpha}{a}\right)$
$f(t-a)$	$\hat{f}(\alpha)\, e^{-ia\alpha}$
$f(t)\, e^{-iat}$	$\hat{f}(\alpha + a)$
$\frac{d^m}{dt^m} f(t)$	$(i\alpha)^m \hat{f}(\alpha)$
$(-it)^m f(t)$	$\frac{d^m}{d\alpha^m}\hat{f}(\alpha)$
$\int_{-\infty}^{\infty} g(t-\tau) f(\tau)\, d\tau$	$\hat{g}(\alpha)\, \hat{f}(\alpha)$

$$\int_{-\infty}^{+\infty} |f(t)|^2\, dt = \frac{1}{2\pi}\int_{-\infty}^{\infty} |\hat{f}(\alpha)|^2\, d\alpha$$

$e^{-t^2/2\sigma^2}$	$\sigma\, e^{-\frac{\alpha^2\sigma^2}{2}}$