

### Fourier Transform Table

$F(t)$	$\widehat{F}(\omega)$	Notes	(0)
$f(t)$	$\int_{-\infty}^{\infty} f(t)e^{-i\omega t} dt$	Definition.	(1)
$\frac{1}{2\pi} \int_{-\infty}^{\infty} \widehat{f}(\omega)e^{i\omega t} d\omega$	$\widehat{f}(\omega)$	Inversion formula.	(2)
$\widehat{f}(-t)$	$2\pi f(\omega)$	Duality property.	(3)
$e^{-at}u(t)$	$\frac{1}{a + i\omega}$	$a$ constant, $\Re(a) > 0$	(4)
$e^{-a t }$	$\frac{2a}{a^2 + \omega^2}$	$a$ constant, $\Re(a) > 0$	(5)
$\beta(t) = \begin{cases} 1, & \text{if }  t  < 1, \\ 0, & \text{if }  t  > 1 \end{cases}$	$2 \operatorname{sinc}(\omega) = 2 \frac{\sin(\omega)}{\omega}$	Boxcar in time.	(6)
$\frac{1}{\pi} \operatorname{sinc}(t)$	$\beta(\omega)$	Boxcar in frequency.	(7)
$f'(t)$	$i\omega \widehat{f}(\omega)$	Derivative in time.	(8)
$f''(t)$	$(i\omega)^2 \widehat{f}(\omega)$	Higher derivatives similar.	(9)
$tf(t)$	$i \frac{d}{d\omega} \widehat{f}(\omega)$	Derivative in frequency.	(10)
$t^2 f(t)$	$i^2 \frac{d^2}{d\omega^2} \widehat{f}(\omega)$	Higher derivatives similar.	(11)
$e^{i\omega_0 t} f(t)$	$\widehat{f}(\omega - \omega_0)$	Modulation property.	(12)
$f\left(\frac{t - t_0}{k}\right)$	$ke^{-i\omega t_0} \widehat{f}(k\omega)$	Time shift and squeeze.	(13)
$(f * g)(t)$	$\widehat{f}(\omega)\widehat{g}(\omega)$	Convolution in time.	(14)
$u(t) = \begin{cases} 0, & \text{if } t < 0 \\ 1, & \text{if } t > 0 \end{cases}$	$\frac{1}{i\omega} + \pi\delta(\omega)$	Heaviside step function.	(15)
$\delta(t - t_0)f(t)$	$e^{-i\omega t_0} f(t_0)$	Assumes $f$ continuous at $t_0$ .	(16)
$e^{i\omega_0 t}$	$2\pi\delta(\omega - \omega_0)$	Useful for $\sin(\omega_0 t)$ , $\cos(\omega_0 t)$ .	(17)

**Convolution:** 
$$(f * g)(t) = \int_{-\infty}^{\infty} f(t - u)g(u) du = \int_{-\infty}^{\infty} f(u)g(t - u) du.$$

**Parseval:** 
$$\int_{-\infty}^{\infty} |f(t)|^2 dt = \frac{1}{2\pi} \int_{-\infty}^{\infty} |\widehat{f}(\omega)|^2 d\omega.$$