		Table of For	urier Trans	Table of Fourier Transforms NOTE only for a > 0	only for $a > 0$		
f(t)	$F(\omega) = \int_{-\infty}^{\infty} e^{-i\omega t} f(t) dt$	f(t)	$F(\omega) = \int_{-\sigma}^{\infty}$	$F(\omega) = \int_{-\infty}^{\infty} e^{-i\omega t} f(t) dt \parallel f(t)$	f(t)	$F(\omega) = \int_{-\infty}^{\infty} e^{-i\omega t} f(t) dt$	t
$e^{-a t }$	$\frac{2a}{a^2 + \omega^2}$	$\frac{a}{a^2 + t^2}$	$\pi e^{-a \omega }$		e^{-at^2}	$\sqrt{\frac{\pi}{a}} e^{-\omega^2/(4a)}$	
$te^{-a t }$		$\frac{2at}{(a^2 + t^2)^2}$	$-i\pi\omega e^{-a \omega }$		te^{-at^2}	$\frac{-i\sqrt{\pi}}{2a^{3/2}} \omega e^{-\omega^2/(4a)}$	
$ t e^{-a t }$	$\frac{2(a^2 - \omega^2)}{(a^2 + \omega^2)^2}$	$\sin(t)e^{-a t }$	$\frac{-2i\omega}{a^2 + \omega^2}$		$\operatorname{sgn}(t)$	$\frac{2}{i\omega}$	
$\frac{1}{t}$		$\frac{1}{t^n}, n = 1, 2, \dots$	$\frac{(-i)^n \pi}{(n-1)!} \omega^{n-1} \operatorname{sgn}(\omega)$	$^{-1}\mathrm{sgn}(\omega)$	$\frac{1}{\sqrt{ t }}$	$\sqrt{\frac{2\pi}{ \omega }}$	
$\frac{\operatorname{sgn}(t)}{\sqrt{ t }}$	$-i\operatorname{sgn}(\omega)\sqrt{\frac{2\pi}{ \omega }}$	$e^{-at}H(t)$	$\frac{1}{a+i\omega} = \frac{c}{a}$	$\frac{a - i\omega}{a^2 + \omega^2}$	$te^{-at}H(t)$	$\frac{1}{(a+i\omega)^2} = \frac{a^2 - 2i\omega a - \omega^2}{(a^2 + \omega^2)^2}$	$-\frac{\omega^2}{(2)^2}$
$e^{-at}e^{ikt}H(t)$	$\frac{a+i(\omega+k)}{k^2+(a+i\omega)^2}$	$t^n e^{-at} H(t), n = 1, 2, \dots$	$\frac{n!}{(a+i\omega)^{n+1}}$		$\frac{1}{t}e^{-a t }\sin(kt)$		\
$\frac{1}{t}\sin(kt)\operatorname{sgn}(t)$ $i\log\left \frac{\omega-k}{\omega+k}\right $		$e^{-at}\sin(kt)H(t)$	$\frac{k}{k^2 + (a + i\omega)^2}$	$\frac{1}{2}$	$e^{-at}\cos(kt)H(t)$	$\frac{a+i\omega}{k^2+(a+i\omega)^2}$	
$\frac{2a\cos(kt)}{a^2 + t^2}$	$\pi \left(e^{-a \omega + k } + e^{-a \omega - k } \right)$	$\frac{2a\sin(kt)}{a^2 + t^2}$	$i\pi \left(e^{-a \omega+k }\right)$	$i\pi \left(e^{-a \omega+k }-e^{-a \omega-k }\right)$	$\tanh(kt)$	$-\frac{i\pi}{2k}\operatorname{csch}\left(\frac{\pi\omega}{2k}\right)$	
$\operatorname{sech}(kt)$	$-\frac{\pi}{k} \operatorname{sech}\left(\frac{\pi \omega}{2k}\right)$	$\operatorname{sech}^2(kt)$	$\frac{\pi\omega}{k^2}\operatorname{csch}\left(\frac{\pi\omega}{2k}\right)$	$\frac{\beta}{k}$	$\frac{e^{-kt}}{a + e^{-t}}$	$\pi a^{i\omega+k-1}\csc(\pi(k+i\omega))$	
f(t)		$F(\omega) = \int_{-\infty}^{\infty} e^{-i\omega t} f(t) dt$		f(t)	$F(\omega) = \int_{-\infty}^{\infty} e^{-i\omega t} f(t) dt$	f(t)dt	
H(t+	H(t+T) - H(t-T)	$\left rac{2}{\omega} \sin(T\omega) \right $	$\frac{1}{t}$	$\frac{1}{t}\sin(kt)$	$\pi \left[H(\omega + k) - H(\omega - k) \right]$	$[\kappa-k)$	
-L)	(T - t) [H(t + T) - H(t - T)]	$\left \frac{4}{\omega^2} \sin^2 \left(\frac{T\omega}{2} \right) \right $		$\frac{2}{t^2}\sin^2(kt)$	$\pi(2k- \omega)\left[H(\omega -$	$\pi(2k - \omega) \left[H(\omega + 2k) - H(\omega - 2k) \right]$	
$\left \begin{array}{c} t \left[H(t) \right] \end{array}\right $	$t\left[H(t+T)-H(t-T)\right]$	$\left \frac{2i}{\omega^2} (T\omega \cos(T\omega) - \sin(T\omega)) \right $	$T\omega))$	$\frac{2}{t}\sin(kt)H(t)$	$\pi \left[H(\omega + k) - H(\iota$	$\pi \left[H(\omega + k) - H(\omega - k) \right] - i \log \left \frac{\omega + k}{\omega - k} \right $	
-T	$(T - t) \operatorname{sgn}(t) [H(t + T) - H(t - T)]$	$T)$] $\left -\frac{2i}{\omega^2} (T\omega - \sin(T\omega)) \right $		$\frac{1}{t}\cos(kt)$	$i\pi(H(-\omega-k)-H(\omega-k))$	$H(\omega-k))$	
T^2	$(T^2 - t^2) [H(t+T) - H(t-T)]$	$\frac{4}{\omega^3}\left(\sin(T\omega) - T\omega\cos(T\omega)\right)$	$(T\omega)$	$\frac{e^{-kt}}{a - e^{-t}}$	$\pi a^{i\omega + k - 1} \cot(\pi (k + i\omega))$	$\vdash i\omega))$	

f(t)	$F(\omega)$	f(t)	$F(\omega)$	f(t)	$F(\omega)$	f(t)	$F(\omega)$
$\delta(t)$	1	-	$2\pi\delta(\omega)$	$\delta(t-T)$ $e^{-iT\omega}$	$e^{-iT\omega}$	$\cos(kt)$	$\pi \left(\delta(k - \omega) + \delta(k + \omega) \right)$
e^{ikt}	$2\pi\delta(k-\omega)$ $H(t)$ $\pi\delta(\omega) - \frac{i}{\omega}$	$\parallel H(t)$	$\pi\delta(\omega) - rac{i}{\omega}$	H(t-T)	$H(t-T) \mid \pi \delta(\omega) - \frac{i}{\omega} e^{-iT\omega} \mid$	$\sin(kt)$	$i\pi \left(\delta(k+\omega) - \delta(k-\omega)\right)$
$\delta'(t)$	$\dot{\omega}i$	t	$2\pi i\delta'(\omega)$	tH(t)	$i\pi\delta'(\omega) - \frac{1}{\omega^2}$	$\sum_{n=-\infty}^{\infty} \delta(t - nT)$	$\sum_{n=-\infty}^{\infty} \delta(t - nT) \left \frac{2\pi}{T} \sum_{n=-\infty}^{\infty} \delta\left(\omega - n \frac{2\pi}{T}\right) \right $
$\left \begin{array}{c c} \delta^{(n)}(t) & (i\omega)^n \end{array} \right $	$(i\omega)^n$	$ t^n $	$2\pi i^n \delta^{(n)}(\omega)$				
H(t) is the vays real an	Heaviside und positive.	nit step · Consta	function. \blacktriangleright \lnot ants k and T	The $sign$ fun are real. \triangleright	ction $sgn(t) = 1$ if Constant n is a po	$(t > 0, 0 \text{ if } t = 0 \text{ and sitive integer.} \triangleright \delta(t)$	$H(t)$ is the Heaviside unit step function. \blacktriangleright The sign function $\operatorname{sgn}(t) = 1$ if $t > 0$, 0 if $t = 0$ and -1 if $t < 0$. \blacktriangleright Constant a is vays real and positive. \blacktriangleright Constants k and T are real. \blacktriangleright Constant n is a positive integer. \blacktriangleright $\delta(t)$ is the Dirac delta function.
	,		Operation	onal Form	Operational Formulae for Fourier Transforms	Transforms	
	$\int \mathcal{F}[f(t)]$]=F(c)	$\mathcal{F}[f(t)] = F(\omega) = \int_{-\infty}^{\infty} e^{-i\omega t} f(t) dt$	f(t)dt			$\mathcal{F}^{-1}\left[F(\omega)\right] = f(t)$
Linearity	$\mathcal{F}[af]$	$(t) + b_{\mathcal{G}}$	$\mathcal{F}[af(t) + bg(t)] = aF(\omega) + bG(\omega), \text{ if } a, b \in \mathcal{R},$	$+ b G(\omega)$, if	$a,b \in \mathcal{R}$,	$\mathcal{F}^{-1}\left[aF ight($	$\mathcal{F}^{-1}\left[aF(\omega) + bG(\omega)\right] = af(t) + bg(t)$
First Shift	$\mathcal{F}[e^{iut}]$	$\mathcal{F}\left[e^{i\omega t} f(t)\right] = F(\omega)$	$F(\omega - u)$			$\mathcal{F}^{-1}\left[F(\omega-u)\right]$	$\mathcal{F}^{-1}\left[F(\omega - u)\right] = e^{iut} \mathcal{F}^{-1}\left[F(\omega)\right] = e^{iut} f(t)$
Second Shift		-u)] =	$\mathcal{F}[f(t-u)] = e^{-i\omega u} F(\omega)$			$\mathcal{F}^{-1}\left[e^{-i\omega u}F(\omega)\right] =$	$\mathcal{F}^{-1}\left[e^{-i\omega u} F(\omega)\right] = \mathcal{F}^{-1}\left[F(\omega)\right]_{t \to t - u} = f(t - u)$
Ouality	$\mathcal{F}[f(t)]$	$\mathcal{F}[f(t)] = F(\omega)$		$\Rightarrow \mathcal{F}[F(t)] = 2\pi f(-\omega)$	$(-\omega)$	$\mathcal{F}^{-1}\left[F(\omega)\right] = f(t)$	$\mathcal{F}^{-1}[F(\omega)] = f(t) \Rightarrow \mathcal{F}^{-1}[f(\omega)] = \frac{1}{2\pi}F(-t)$
Convolution		$\mathcal{F}\left[f(t)*g(t)\right] = \mathcal{F}$	$= \mathcal{F} \left\{ \int_{-\infty}^{\infty} f(t) dt \right\}$	(u) g(t-u) d	$\left\{ \int_{-\infty}^{\infty} f(u) g(t-u) du \right\} = F(\omega) G(\omega)$		$\mathcal{F}[f(t) g(t)] = \frac{1}{2\pi} F(\omega) * G(\omega)$
Scal. & Reflect.		/a)] =	$ a F(a\omega),$	$\mathcal{F}[f(-t)] =$	$F(-\omega) = F^*(\omega),$	$\mathcal{F}[f(t/a)] = a F(a\omega), \qquad \mathcal{F}[f(-t)] = F(-\omega) = F^*(\omega), F^* \text{ is the complex conjugate of } F$	onjugate of F.
Parseval's Thm.		$ f(t) ^2 dt$	$\int_{-\infty}^{\infty} f(t) ^2 dt = \frac{1}{2\pi} \int_{-\infty}^{\infty} F(\omega) ^2 d\omega$	$ \omega ^2 d\omega$	Energy in fr	Energy in frequency range $\omega_1 < \omega < \omega_2$	$ \omega < \omega_2$ $\frac{1}{\pi} \int_{\omega_1}^{\omega_2} F(\omega) ^2 d\omega$
	L # WP] —				- (1)	-	

ightharpoonup H(t) is the Hea always real and pos	▶ $H(t)$ is the Heaviside unit step function. ▶ The $sign$ function $sgn(t) = 1$ if $t > 0$, 0 if $t = 0$ and -1 if $t < 0$. ▶ Constant a is always real and positive. ▶ Constants k and T are real. ▶ Constant n is a positive integer. ▶ $\delta(t)$ is the Dirac delta function.	$t>0, 0$ if $t=0$ and -1 if $t<0.$ \blacktriangleright Constant a is sitive integer. \blacktriangleright $\delta(t)$ is the Dirac delta function.
	Operational Formulae for Fourier Transforms	Transforms
	$\mathcal{F}[f(t)] = F(\omega) = \int_{-\infty}^{\infty} e^{-i\omega t} f(t) dt$	$\mathcal{F}^{-1}\left[F(\omega)\right] = f(t)$
Linearity	$\mathcal{F}[a f(t) + b g(t)] = a F(\omega) + b G(\omega), \text{ if } a, b \in \mathcal{R},$	$\mathcal{F}^{-1}\left[aF(\omega) + bG(\omega)\right] = af(t) + bg(t)$
First Shift	$\mathcal{F}\left[e^{iut} f(t)\right] = F(\omega - u)$	$\mathcal{F}^{-1}\left[F(\omega - u)\right] = e^{iut} \mathcal{F}^{-1}\left[F(\omega)\right] = e^{iut} f(t)$
Second Shift	$\mathcal{F}[f(t-u)] = e^{-i\omega u} F(\omega)$	$\mathcal{F}^{-1}\left[e^{-i\omega u} F(\omega)\right] = \mathcal{F}^{-1}\left[F(\omega)\right] _{t \to t - u} = f(t - u)$
Duality	$\mathcal{F}[f(t)] = F(\omega) \Rightarrow \mathcal{F}[F(t)] = 2\pi f(-\omega)$	$\mathcal{F}^{-1}[F(\omega)] = f(t) \Rightarrow \mathcal{F}^{-1}[f(\omega)] = \frac{1}{2\pi}F(-t)$
Convolution	$\mathcal{F}[f(t) * g(t)] = \mathcal{F}\left\{\int_{-\infty}^{\infty} f(u) g(t-u) du\right\} = F(\omega) G(\omega)$	$\mathcal{F}\left[f(t)g(t) ight]=rac{1}{2\pi}F(\omega)*G(\omega)$
Scal. & Reflect.	$\mathcal{F}[f(t/a)] = a F(a\omega), \qquad \mathcal{F}[f(-t)] = F(-\omega) = F^*(\omega), F^* \text{ is the complex conjugate of } F.$	F^* is the complex conjugate of F .
Parseval's Thm.	$\left\ \int_{-\infty}^{\infty} f(t) ^2 dt = \frac{1}{2\pi} \int_{-\infty}^{\infty} F(\omega) ^2 d\omega $ Energy in fr	Energy in frequency range $\omega_1 < \omega < \omega_2$ $\frac{1}{\pi} \int_{\omega_1}^{\omega_2} F(\omega) ^2 d\omega$
Derivatives	$\mathcal{F}\left[\frac{d^n f}{dt^n}\right] = (i\omega)^n F(\omega), \text{ where } f, f', \dots, f^{(n-1)} \to 0 \text{ as } x \to \infty$	8
Mult. by t	$\mathcal{F}[tf(t)] = i\frac{d}{d\omega}F(\omega) = iF'(\omega), \qquad \mathcal{F}[t^nf(t)] = \left(i\frac{d}{d\omega}\right)^nF(\omega)$	$r(\omega)$
Integrals	$\left\ \mathcal{F} \left\{ \int_{\pm \infty}^{t} f(u) du \right\} = -\frac{i}{\omega} F(\omega), \text{ providing } \int_{-\infty}^{\infty} f(t) dt = 0 \right\ $	$\mathcal{F}\left\{ \int_{-\infty}^{\infty} f(u) f(u+t) du \right\} = F(\omega) ^{2}$
Modulation	$\mathcal{F}[f(t) \cos(\omega_0 t)] = \frac{1}{2} \left(F(\omega - \omega_0) + F(\omega + \omega_0) \right)$	