Table 4.1

A Short Table of Fourier Transforms

	$f(t)$	$F(\omega)$	
1	$e^{-at}u(t)$	$\frac{1}{a+j\omega}$	$a > 0$
2	$e^{at}u(-t)$	$\frac{1}{a-j\omega}$	$a > 0$
3	$e^{-a\|t\|}$	$\frac{2a}{a^2+\omega^2}$	$a > 0$
4	$te^{-at}u(t)$	$\frac{1}{(a+j\omega)^2}$	$a > 0$
5	$t^n e^{-at}u(t)$	$\frac{n!}{(a+j\omega)^{n+1}}$	$a > 0$
6	$\delta(t)$	1	
7	1	$2\pi\delta(\omega)$	
8	$e^{j\omega_0 t}$	$2\pi\delta(\omega-\omega_0)$	
9	$\cos\omega_0 t$	$\pi[\delta(\omega-\omega_0)+\delta(\omega+\omega_0)]$	
10	$\sin\omega_0 t$	$j\pi[\delta(\omega+\omega_0)-\delta(\omega-\omega_0)]$	
11	$u(t)$	$\pi\delta(\omega)+\frac{1}{j\omega}$	
12	$\operatorname{sgn} t$	$\frac{2}{j\omega}$	
13	$\cos\omega_0 t\, u(t)$	$\frac{\pi}{2}[\delta(\omega-\omega_0)+\delta(\omega+\omega_0)]+\frac{j\omega}{\omega_0^2-\omega^2}$	
14	$\sin\omega_0 t\, u(t)$	$\frac{\pi}{2j}[\delta(\omega-\omega_0)-\delta(\omega+\omega_0)]+\frac{\omega_0}{\omega_0^2-\omega^2}$	
15	$e^{-at}\sin\omega_0 t\, u(t)$	$\frac{\omega_0}{(a+j\omega)^2+\omega_0^2}$	$a > 0$
16	$e^{-at}\cos\omega_0 t\, u(t)$	$\frac{a+j\omega}{(a+j\omega)^2+\omega_0^2}$	$a > 0$
17	$\operatorname{rect}\left(\frac{t}{\tau}\right)$	$\tau \operatorname{sinc}\left(\frac{\omega\tau}{2}\right)$	
18	$\frac{W}{\pi}\operatorname{sinc}(Wt)$	$\operatorname{rect}\left(\frac{\omega}{2W}\right)$	
19	$\Delta\left(\frac{t}{\tau}\right)$	$\frac{\tau}{2}\operatorname{sinc}^2\left(\frac{\omega\tau}{4}\right)$	
20	$\frac{W}{2\pi}\operatorname{sinc}^2\left(\frac{Wt}{2}\right)$	$\Delta\left(\frac{\omega}{2W}\right)$	
21	$\sum_{n=-\infty}^{\infty}\delta(t-nT)$	$\omega_0\sum_{n=-\infty}^{\infty}\delta(\omega-n\omega_0)$	$\omega_0=\frac{2\pi}{T}$
22	$e^{-t^2/2\sigma^2}$	$\sigma\sqrt{2\pi}e^{-\sigma^2\omega^2/2}$	

Transform pair	Signal	Transform	ROC
1	$\delta(t)$	1	All s
2	$u(t)$	$\frac{1}{s}$	Re{s} > 0
3	$u(-t)$	$\frac{1}{s}$	Re{s} < 0
4	$\frac{t^{n-1}}{(n-1)!}u(t)$	$\frac{1}{s^n}$	Re{s} < 0
5	$-\frac{t^{n-1}}{(n-1)!}u(-t)$	$\frac{1}{s^n}$	Re{s} < 0
6	$e^{-\alpha t}u(t)$	$\frac{1}{s+\alpha}$	Re{s} > $-\alpha$
7	$-e^{-\alpha t}u(-t)$	$\frac{1}{s+\alpha}$	Re{s} < $-\alpha$
8	$\frac{t^{n-1}}{(n-1)!}e^{-\alpha t}u(t)$	$\frac{1}{(s+\alpha)^n}$	Re{s} > $-\alpha$
9	$-\frac{t^{n-1}}{(n-1)!}e^{-\alpha t}u(-t)$	$\frac{1}{(s+\alpha)^n}$	Re{s} < $-\alpha$
10	$\delta(t-T)$	e^{-sT}	All s
11	$[\cos\omega_0 t]u(t)$	$\frac{s}{s^2+\omega_0^2}$	Re{s} > 0
12	$[\sin\omega_0 t]u(t)$	$\frac{\omega_0}{s^2+\omega_0^2}$	Re(s) > 0
13	$\left[e^{-\alpha t}\cos\omega_0 t\right]u(t)$	$\frac{s+\alpha}{(s+\alpha^2)+\omega_0^2}$	Re{s} > $-\alpha$
14	$\left[e^{-\alpha t}\sin\omega_0 t\right]u(t)$	$\frac{\omega_0}{(s+\alpha)^2+\omega_0^2}$	Re{s} > $-\alpha$
15	$u_n(t) = \frac{d^n\delta(t)}{dt^n}$	s^n	All s
16	$u_{-n}(t) = \underbrace{u(t) * \cdots * u(t)}_{n \text{ times}}$	$\frac{1}{s^n}$	Re{s} > 0

S.No.	Form of the rational function	Form of the partial fraction
1.	$\dfrac{px+q}{(x-a)(x-b)}, a \neq b$	$\dfrac{A}{x-a}+\dfrac{B}{x-b}$
2.	$\dfrac{px+q}{(x-a)^2}$	$\dfrac{A}{x-a}+\dfrac{B}{(x-a)^2}$
3.	$\dfrac{px^2+qx+r}{(x-a)(x-b)(x-c)}$	$\dfrac{A}{x-a}+\dfrac{B}{x-b}+\dfrac{C}{x-c}$
4.	$\dfrac{px^2+qx+r}{(x-a)^2(x-b)}$	$\dfrac{A}{x-a}+\dfrac{B}{(x-a)^2}+\dfrac{C}{x-b}$
5.	$\dfrac{px^2+qx+r}{(x-a)(x^2+bx+c)}$ where $x^2 + bx + c$ cannot be factorised further	$\dfrac{A}{x-a}+\dfrac{Bx+C}{x^2+bx+c}$,

Signal $x[n]$	z-Transform $X(z)$	ROC
$\delta[n]$	1	All z
$u[n]$	$\frac{1}{1-z^{-1}}$	$\lvert z\rvert > 1$
$n\,u[n]$	$\frac{z^{-1}}{\left(1-z^{-1}\right)^2}$	$\lvert z\rvert > 1$
$a^n u[n]$	$\frac{1}{1-az^{-1}}$	$\lvert z\rvert > \lvert a\rvert$
$na^n\,u[n]$	$\frac{az^{-1}}{\left(1-az^{-1}\right)^2}$	$\lvert z\rvert > \lvert a\rvert$
$-a^n u[-n-1]$	$\frac{1}{1-az^{-1}}$	$\lvert z\rvert < \lvert a\rvert$
$-na^n\,u[-n-1]$	$\frac{az^{-1}}{\left(1-az^{-1}\right)^2}$	$\lvert z\rvert < \lvert a\rvert$
$(\cos\omega_o n)u[n]$	$\frac{1-z^{-1}\cos\omega_o}{1-2z^{-1}\cos\omega_o+z^{-2}}$	$\lvert z\rvert > 1$
$(\sin\omega_o n)u[n]$	$\frac{z^{-1}\sin\omega_o}{1-2z^{-1}\cos\omega_o+z^{-2}}$	$\lvert z\rvert > 1$
$(a^n\cos\omega_o n)u[n]$	$\frac{1-az^{-1}\cos\omega_o}{1-2az^{-1}\cos\omega_o+a^2z^{-2}}$	$\lvert z\rvert > \lvert a\rvert$
$(a^n\sin\omega_o n)u[n]$	$\frac{az^{-1}\sin\omega_o}{1-2az^{-1}\cos\omega_o+a^2z^{-2}}$	$\lvert z\rvert > \lvert a\rvert$

	Continuous-time signals	Discrete-time signals
Total energy of the nonperiodic signal $g(t)$ or $g(n)$	$E = \int_{-\infty}^{\infty} \lvert g(t)\rvert^2 dt$	$E = \sum_{n=-\infty}^{\infty} \lvert g(n)\rvert^2$
Average power of the nonperiodic signal $g(t)$ or $g(n)$	$P = \lim_{S\to\infty} \left(\frac{1}{2S}\right) \int_{-S}^{S} \lvert g(t)\rvert^2 dt$	$P = \lim_{N\to\infty} \left(\frac{1}{2N}\right) \sum_{n=-\infty}^{\infty} \left\lvert g(n)\right\rvert^2$
Average power of the periodic signal $g(t)$ or $g(n)$	$P = \left(\frac{1}{T_0}\right) \int_{-T_0/2}^{T_0/2} \lvert g(t)\rvert^2 dt$	$P = \left(\frac{1}{N}\right) \sum_{n=0}^{N-1} \left\lvert g(n)\right\rvert^2$