SOME USEFUL FORMULAS

$$\sin\alpha \pm \sin\beta = 2\sin\frac{1}{2}(\alpha \pm \beta)\cos\frac{1}{2}(\alpha \mp \beta)$$

$$\cos\alpha + \cos\beta = 2\cos\frac{1}{2}(\alpha + \beta)\cos\frac{1}{2}(\alpha - \beta)$$

$$X(jw) = \int_{-\infty}^{\infty} x(t)e^{-j\omega t}dt \qquad x(t) = \frac{1}{2\pi}\int_{-\infty}^{\infty} X(jw)e^{j\omega t}dt$$

$$x(t) = A_0 + \sum_{k=1}^{N} A_k \cos(2\pi f_k t + \varphi_k)$$

$$f(x) = a_0 + \sum_{n=1}^{\infty}\left(a_n \cos\frac{n\pi x}{L} + b_n \sin\frac{n\pi x}{L}\right)$$

$$H(z) = \sum_{n=0}^{\infty} a^n z^{-n} = \frac{1}{1 - az^{-1}} \qquad \boxed{|a| < z.}$$

$$\boxed{a^n u[n] \iff \frac{1}{1 - az^{-1}}}$$

$$y[n] = \sum_{k=0}^{M} b_k x[n-k] = \sum_{k=0}^{M} b_k A e^{j\varphi} e^{j\hat{\omega}(n-k)}$$

$$e^x = 1 + \frac{x}{1} + \frac{x^2}{2.1} + \frac{x^3}{3.2.1} + \frac{x^4}{4.3.2.1} + \ldots.$$

$$1 + x + x^2 + x^3 + x^4 + \ldots x^N = \frac{1 - x^{N+1}}{1 - x}, \quad x < 1$$

Time-Domain: $x(t)$	***Frequency-Domain: $X(j\omega)$***
$e^{-at}u(t) \quad (a > 0)$	$\frac{1}{a + j\omega}$
$e^{bt}u(-t) \quad (b > 0)$	$\frac{1}{b - j\omega}$
$u(t + \frac{1}{2}T) - u(t - \frac{1}{2}T)$	$\frac{\sin(\omega T/2)}{\omega/2}$
$\frac{\sin(\omega_b t)}{\pi t}$	$[u(\omega + \omega_b) - u(\omega - \omega_b)]$
$\delta(t)$	1
$\delta(t - t_d)$	$e^{-j\omega t_d}$
$u(t)$	$\pi\delta(\omega) + \frac{1}{j\omega}$
1	$2\pi\delta(\omega)$
$e^{j\omega_0 t}$	$2\pi\delta(\omega - \omega_0)$
$A\cos(\omega_0 t + \phi)$	$\pi A e^{j\phi}\delta(\omega - \omega_0) + \pi A e^{-j\phi}\delta(\omega + \omega_0)$
$\cos(\omega_0 t)$	$\pi\delta(\omega - \omega_0) + \pi\delta(\omega + \omega_0)$
$\sin(\omega_0 t)$	$-j\pi\delta(\omega - \omega_0) + j\pi\delta(\omega + \omega_0)$