

# Formula Sheet

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## Useful integrals

$$\int x \sin(ax) dx = \frac{1}{a^2} \sin(ax) - \frac{1}{a} x \cos(ax)$$

$$\int x \cos(ax) dx = \frac{1}{a^2} \cos(ax) + \frac{1}{a} x \sin(ax)$$

## Fourier Series Coefficients

$$a_0 = \frac{1}{T} \int_0^T f(t) dt$$

$$a_n = \frac{2}{T} \int_0^T f(t) \cos(n\omega_0 t) dt$$

$$b_n = \frac{2}{T} \int_0^T f(t) \sin(n\omega_0 t) dt$$

$$F_n = \frac{1}{T} \int_0^T f(t) e^{-jn\omega_0 t} dt$$

## Laplace Transform Pairs

$f(t)$	$F(s)$
$\delta(t)$	$1$
$u(t)$	$\frac{1}{s}$
$e^{-at}u(t)$	$\frac{1}{s+a}$
$\cos(\omega_0 t)u(t)$	$\frac{s}{s^2 + \omega_0^2}$
$\sin(\omega_0 t)u(t)$	$\frac{\omega_0}{s^2 + \omega_0^2}$

## Properties of the Laplace Transform

$g(t)$	$G(s)$
$e^{-at}f(t)$	$F(s+a)$
$f(t-t_0)$	$e^{-st_0}F(s)$
$\frac{df(t)}{dt}$	$sF(s) - f(0)$
$\int_0^t f(\tau) d\tau$	$\frac{F(s)}{s}$
$tf(t)$	$-\frac{dF(s)}{ds}$

## Two-port networks

<b>Z-Parameters</b>	<b>Y-Parameters</b>
$V_1 = z_{11}I_1 + z_{12}I_2$ $V_2 = z_{21}I_1 + z_{22}I_2$	$I_1 = y_{11}V_1 + y_{12}V_2$ $I_2 = y_{21}V_1 + y_{22}V_2$
<b>H-Parameters</b>	<b>A-Parameters</b>
$V_1 = h_{11}I_1 + h_{12}V_2$ $I_2 = h_{21}I_1 + h_{22}V_2$	$V_1 = a_{11}V_2 - a_{12}I_2$ $I_1 = a_{21}V_2 - a_{22}I_2$