Properties

Linearity

$$a x_1(t) + b x_2(t) \longleftrightarrow a X_1(t) + b X_2(t)$$

Time shifting

$$x(t - t_0) \longleftrightarrow e^{-st_0} X(s)$$
$$x(t + t_0) \longleftrightarrow e^{st_0} X(s)$$

Time scaling

$$x(at) \longleftrightarrow \frac{1}{|a|} X\left(\frac{s}{a}\right)$$

Time reversal

$$x(-t) \longleftrightarrow X(-s)$$

Transform of derivatives

$$\frac{d^2 x(t)}{dt^2} \longleftrightarrow s^2 X(s) - s\, x(0^-) - \frac{dx(0^-)}{dt}$$

Transform of integrals

$$\int_{-\infty}^{t} x(\tau)\, d\tau \longleftrightarrow \frac{X(s)}{s} + \frac{1}{s} \int_{-\infty}^{0} x(\tau)\, d\tau$$

Differentiation in s domain

$$t^n \longleftrightarrow \frac{n!}{s^{n+1}}$$

Frequency shifting

$$e^{-at} x(t) \longleftrightarrow X(s + a)$$

Time convolution

$$x_1(t) * x_2(t) \longleftrightarrow X_1(s)\, X_2(s)$$

Multiplication

$$x_1(t)\, x_2(t) \longleftrightarrow \frac{1}{2\pi j} [X_1(s) * X_2(s)]$$

Initial value theorem

$$x(0) = \lim_{t \to 0} x(t) = \lim_{s \to \infty} s X(s)$$

Final value theorem

$$x(\infty) = \lim_{t \to \infty} x(t) = \lim_{s \to 0} s X(s)$$