**Laplace Transforms**

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$$L(f(t)) = \int_0^\infty e^{-st} f(t)dt$$

$$L(1) = \frac{1}{s}$$

$$L(t^n) = \frac{n!}{s^{n+1}}$$

$$L(e^{at}) = \frac{1}{s-a}$$

$$L(t^n e^{at}) = \frac{n!}{(s-a)^{n+1}}$$

$$L(\sin kt) = \frac{k}{s^2+k^2}$$

$$L(\cos kt) = \frac{s}{s^2+k^2}$$

$$L(e^{at} f(t)) = F(s-a)$$

$$L(t^n f(t)) = (-1)^n \frac{d^n}{ds^n}(F(s))$$

$$L(f(t-a)U(t-a)) = e^{-as}F(s)$$

$$L(U(t-a)) = \frac{e^{-as}}{s}$$

$$L(f^n(t)) = s^n F(s) - s^{n-1} f(0) - s^{n-2} f'(0) - \ldots\ldots - f^{n-1}(0)$$

$$f*g = \int_0^t f(\tau)g(t-\tau)d\tau$$

$$L(f*g) = F(s).G(s)$$

$$L\left(\int_0^t f(t)dt\right) = \frac{F(s)}{s}$$

Let f(t) be piecewise continuous on $[0,\infty)$ $[0,\infty)$ and of exponential order. If f(t) is periodic with period T, then

$$L(f(t)) = \frac{1}{1-e^{-sT}} \int_0^T e^{-st} f(t)dt$$