Formula Sheet

1) $L\{f(t)\} = \int_0^\infty e^{-st} f(t)\,dt$ $\qquad$ $U_a(t) \equiv U(t-a) = \begin{cases} 0, & 0 \le t < a \\ 1, & a \le t < \infty \end{cases}$

2) $L\{1\} = \dfrac{1}{s}$, $\qquad L\{e^{at}\} = \dfrac{1}{s-a}$ $\qquad L\{t^n\} = \dfrac{n!}{s^{n+1}}$, **n is a positive integer**

3) $L\{\sin kt\} = \dfrac{k}{s^2 + k^2}$ $\qquad\qquad L\{\cos kt\} = \dfrac{s}{s^2 + k^2}$

4) $L\{\sinh kt\} = \dfrac{k}{s^2 - k^2}$ $\qquad\qquad L\{\cosh kt\} = \dfrac{s}{s^2 - k^2}$

5) $L\{e^{at} f(t)\} = F(s)\big|_{s \to s-a}$ $\qquad\qquad L^{-1}\{F(s)\big|_{s \to s-a}\} = e^{at} f(t)$

6) $L\{U(t-a)\} = \dfrac{e^{-as}}{s}$ $\qquad\qquad L^{-1}\{\dfrac{e^{-as}}{s}\} = U(t-a)$

7) $L\{g(t)U(t-a)\} = e^{-as} L\{g(t+a)\}$ $\qquad L^{-1}\{e^{-as} F(s)\} = f(t-a)U(t-a)$

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

9) $L\{y'(t)\} = sY(s) - y(0)$ $\qquad\qquad L\{y''(t)\} = s^2 Y(s) - sy(0) - y'(0)$

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

11) $L\{f(t) * g(t)\} = F(s).G(s)$ $\qquad\qquad f(t) * g(t) = \int_0^t f(\tau) g(t-\tau)\,d\tau$

12) $L\{\int_0^t f(\tau)d\tau\} = \dfrac{F(s)}{s}$ $\qquad\qquad L^{-1}\{F(s).G(s)\} = f(t) * g(t)$

13) $L\{\delta(t)\} = 1$ $\qquad\qquad L\{\delta(t-a)\} = e^{-as}$

14) **If** $f(t)$ **is periodic with period** T **then** $L\{f(t)\} = \dfrac{1}{1-e^{-Ts}} \int_0^T e^{-st} f(t)\,dt$

$\sin(A+B) = \sin A \cos B + \cos A \sin B$ $\qquad \sin A \cos B = \dfrac{1}{2}[\cos(A-B) - \cos(A+B)]$