Differential Equations MATH 225
TABLE OF LAPLACE TRANSFORMS

No.	Function $f(t)$	Laplace Transform $F(s)$	No.	Function $f(t)$	Laplace Transform $F(s)$
1.	$f'(t)$	$sF(s) - f(0)$	12.	e^{at}	$\dfrac{1}{s-a}$
2.	$f''(t)$	$s^2F(s) - sf(0) - f'(0)$	13.	$\cos kt$	$\dfrac{s}{s^2+k^2}$
3.	$\int_0^t f(\tau)\, d\tau$	$\dfrac{F(s)}{s}$	14.	$\sin kt$	$\dfrac{k}{s^2+k^2}$
4.	$e^{at}f(t)$	$F(s-a)$	15.	$t^n f(t)$	$(-1)^n F^{(n)}(s)$
5.	$\mathcal{U}(t-a)f(t-a)$	$e^{-as}F(s)$	16.	$t^n e^{at}$	$\dfrac{n!}{(s-a)^{n+1}}$
6.	f(t)*g(t) $= \int_0^t f(\tau)g(t-\tau)\, d\tau$	$F(s)G(s)$	17.	$e^{at}\cos kt$	$\dfrac{s-a}{(s-a)^2+k^2}$
7.	1	$\dfrac{1}{s}$	18.	$e^{at}\sin kt$	$\dfrac{k}{(s-a)^2+k^2}$
8.	t	$\dfrac{1}{s^2}$	19.	$\mathcal{U}(t-a)$	$\dfrac{e^{-as}}{s}$
9.	t^n	$\dfrac{n!}{s^{n+1}}$	20.	$\delta(t-t_0)$	$e^{-s\,t_0}$
10.	$\cosh kt$	$\dfrac{s}{s^2-k^2}$	21.	$\sinh kt$	$\dfrac{k}{s^2-k^2}$
11.	$\dfrac{1}{2k^3}(\sin kt - kt\cos kt)$	$\dfrac{1}{(s^2+k^2)^2}$	22.	$\dfrac{t}{2k}\sin kt$	$\dfrac{s}{(s^2+k^2)^2}$

Four useful formulas

$$\int_0^\infty \delta(t-t_0)f(t)\, dt = f(t_0)$$

$$\int_0^t \delta(\tau-t_0)g(t-\tau)\, d\tau = \mathcal{U}(t-t_0)g(t-t_0)$$

$$F(s) = \mathcal{L}\{f(t)\} = \frac{1}{1-\mathrm{e}^{-sT}}\int_0^T \mathrm{e}^{-st}f(t)dt \quad \text{if } f(t+T) = f(t)$$

$$\mathcal{L}\{g(t)\mathcal{U}(t-a)\} = e^{-as}\mathcal{L}\{g(t+a)\} \text{ (Alternative Form of 5.)}$$