MATH 224-02 **TABLE OF LAPLACE TRANSFORMS**

In the following Laplace-transform table everywhere $f(t)$ is the original function, and $F(s)$ its Laplace transform:

$f(t) = \mathcal{L}^{-1}(F)(t)$	$F(s) = \mathcal{L}(f)(s)$
$f(t) \equiv C = \text{const}$	$F(s) = \dfrac{C}{s}, \quad s > 0$
$f(t) = e^{at}$	$F(s) = \dfrac{1}{s-a}, \quad s > a$
$f(t) = t^n$	$F(s) = \dfrac{n!}{s^{n+1}}, \quad s > 0$
$f(t) = t^n\, e^{at}$	$F(s) = \dfrac{n!}{(s-a)^{n+1}}, \quad s > a$
$f(t) = \sin bt$	$F(s) = \dfrac{b}{s^2+b^2}, \quad s > 0$
$f(t) = \cos bt$	$F(s) = \dfrac{s}{s^2+b^2}, \quad s > 0$

Remember that the Laplace transform and the inverse Laplace transform are linear.

Also let me remind you some properties of the Laplace transform (the formulation in the language of the inverse Laplace transform is not given):

$$\mathcal{L}\{f'(t)\}(s) = s \cdot \mathcal{L}\{f(t)\}(s) - f(0),$$
$$\mathcal{L}\{f''(t)\}(s) = s^2 \cdot \mathcal{L}\{f(t)\}(s) - s \cdot f(0) - f'(0),$$

etc;

$$\mathcal{L}\{e^{at}\, f(t)\}(s) = \mathcal{L}\{f(t)\}(s-a), \quad \text{or:} \quad \mathcal{L}^{-1}\{F(s-a)\}(t) = e^{at}\, \mathcal{L}^{-1}\{F(s)\}(t);$$

$$\mathcal{L}\{t^n\, f(t)\}(s) = (-1)^n \frac{d^n \mathcal{L}(f)}{ds^n}(s), \quad \text{or:} \quad \mathcal{L}^{-1}\Big\{\frac{d^n F}{ds^n}(s)\Big\}(t) = (-1)^n t^n\, \mathcal{L}^{-1}\{F(s)\}(t);$$

$$\mathcal{L}\{H(t-a) \cdot f(t-a)\}(s) = e^{-as}\, \mathcal{L}\{f(t)\}(s),$$
$$\text{or:} \quad \mathcal{L}^{-1}\{e^{-as} F(s)\}(t) = H(t-a) \cdot \mathcal{L}^{-1}\{F(s)\}(t-a),$$

where $H(t)$ is the Heaviside function; the Laplace transform of the convolution $(f * g)(t) = \int_0^t f(u)\, g(t-u)\, du$ is

$$\mathcal{L}(f * g)(s) = \mathcal{L}(f)(s) \cdot \mathcal{L}(g)(s), \qquad \text{or:} \quad \mathcal{L}^{-1}(F \cdot G)(t) = \big[\big(\mathcal{L}^{-1}(F)\big) * \big(\mathcal{L}^{-1}(G)\big)\big](t).$$