Some Laplace Transform Pairs

	$f(t)$	F(s)
1.	1	$1/s$
2.	t	$1/s^2$
3.	e^{-at}	$1/(s+a)$
4.	te^{-at}	$1/(s+a)^2$
5.	$\frac{t^{n-1}}{(n-1)!}e^{-at}$	$(s+a)^{-n}$
6.	$\sin(\omega t)$	$\omega/(s^2+\omega^2)$
7.	$\cos(\omega t)$	$s/(s^2+\omega^2)$
8.	$e^{-at}\sin(\omega t)$	$\omega/[(s+a)^2+\omega^2]$
9.	$e^{-at}\cos(\omega t)$	$(s+a)/[(s+a)^2+\omega^2]$
10.	$\sqrt{c^2+d^2}\, e^{-at} \cos\left(\omega t - \tan^{-1}\left(\frac{d}{c}\right)\right)$	$\frac{c(s+a)+d\omega}{(s+a)^2+\omega^2}$
11.	$\sinh(\omega t)$	$\omega/(s^2-\omega^2)$
12.	$\cosh(\omega t)$	$s/(s^2-\omega^2)$
Special Transforms		
13.	$\frac{df}{dt}$	$s\,F(s) - f(0^+)$
14.	$\int_0^t f(\tau)\,d\tau$	$F(s)/s$
15.	$c_1 f_1(t) + c_2 f_2(t)$	$c_1 F_1(s) + c_2 F_2(s)$
16.	$\int f_1(\tau)\, f_2(t-\tau)\,d\tau$	$F_1(s)\, F_2(s)$
17.	$\delta(t\text{-}T)$ (delta function, T > 0)	e^{-sT}
18.	$\frac{d^n}{dt^n}(\delta(t)) = \delta^{(n)}(t)$ (n-th derivative of delta function)	s^n
19.	$\delta^{(-n)}(t)$ (n-th integral of delta function)	s^{-n}

Comments on Transforms.

A) The transform variable, s, is complex. The Fourier transform is the special case of this more general transform where s is restricted to be pure imaginary.

B) In the table above, a, c, and d are considered real constants, though many of the transforms are still valid if they are complex or pure imaginary.

C) 1 to 4 are special cases of 5.

D) 1, 3, and 6 to 9 are special cases of 10.

E) 6 and 7 are related to 11 and 12. If you replace ω with $i\omega$ in one pair, you generate the other.

F) 15 is a statement of the linearity of the transform.

G) 14 is a special case of 16 (where one of the functions is constant).

H) 16 is known as the "convolution theorem."

I) 18 is particularly useful if you have an equation with a delta-function in it and need to take a derivative. This occurs for some idealized models of real systems (*e.g.* In E&M, current through a thin wire is often modeled using a delta function for the current density.).