## Information for exam #1 in 421:01, fall 2005

### Laplace transforms

<table>
<thead>
<tr>
<th>Function</th>
<th>Laplace Transform</th>
</tr>
</thead>
<tbody>
<tr>
<td>( f(t) )</td>
<td>( F(s) = \int_{0}^{\infty} e^{-st} f(t) , dt )</td>
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<tr>
<td>( af(t) + bg(t) )</td>
<td>( aF(s) + bG(s) )</td>
</tr>
<tr>
<td>( t^n ) (positive integer ( n ))</td>
<td>( \frac{n!}{s^{n+1}} )</td>
</tr>
<tr>
<td>( e^{at} )</td>
<td>( \frac{1}{s-a} )</td>
</tr>
<tr>
<td>( \sin(kt) )</td>
<td>( \frac{k}{s^2 + k^2} )</td>
</tr>
<tr>
<td>( \cos(kt) )</td>
<td>( \frac{s}{s^2 + k^2} )</td>
</tr>
<tr>
<td>( e^{at} f(t) )</td>
<td>( F(s-a) )</td>
</tr>
<tr>
<td>( U(t-a)f(t-a) )</td>
<td>( e^{-as} F(s) )</td>
</tr>
<tr>
<td>( g(t)U(t-a) )</td>
<td>( e^{-as} \mathcal{L}{g(t+a)} )</td>
</tr>
<tr>
<td>( f'(t) )</td>
<td>( sF(s) - f(0^+) )</td>
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<tr>
<td>( f^{(n)}(t) )</td>
<td>( s^n F(s) - s^{n-1} f(0) - \ldots - f^{(n-1)}(0) )</td>
</tr>
<tr>
<td>( (f * g)(t) = \int_{0}^{t} f(t - \tau) g(\tau) , d\tau )</td>
<td>( F(s)G(s) )</td>
</tr>
<tr>
<td>( \delta(t-a) )</td>
<td>( e^{-as} )</td>
</tr>
<tr>
<td>( \int_{0}^{t} f(w) , dw )</td>
<td>( \frac{1}{s} F(s) )</td>
</tr>
<tr>
<td>( t^n f(t) )</td>
<td>( (-1)^n \frac{d^n}{ds^n} F(s) )</td>
</tr>
<tr>
<td>( f(t + T) = f(t) ) (periodic)</td>
<td>( \frac{1}{1 - e^{-sT}} \int_{0}^{T} e^{-st} f(t) , dt )</td>
</tr>
</tbody>
</table>

\[
\sin(A + B) = \sin A \cos B + \cos A \sin B \\
\cos(A + B) = \cos A \cos B - \sin A \sin B
\]