

Math 217 - November 5, 2010

$\mathcal{L}\{e^{at}\} = \frac{1}{s-a}$	$\mathcal{L}\{t^n\} = \frac{n!}{s^{n+1}}$
$\mathcal{L}\{t^a\} = \frac{\Gamma(a+1)}{s^{a+1}}$	$\mathcal{L}\{u_a(t)\} = \frac{e^{-sa}}{s}$
$\mathcal{L}\{\cosh(at)\} = \frac{s}{s^2-a^2}$	$\mathcal{L}\{\sinh(at)\} = \frac{a}{s^2-a^2}$
$\mathcal{L}\{\cos(at)\} = \frac{s}{s^2+a^2}$	$\mathcal{L}\{\sin(at)\} = \frac{a}{s^2+a^2}$
$\mathcal{L}\{f'(t)\} = sF(s) - f(0)$	$\mathcal{L}\{e^{at}f(t)\} = F(s-a)$
$\mathcal{L}\left\{\int_0^t f(u) du\right\} = \frac{1}{s}F(s)$	$\mathcal{L}^{-1}\left\{\frac{1}{s}F(s)\right\} = \int_0^t f(u) du$
$(f * g)(t) = \int_0^t f(u)g(t-u) du$	$\mathcal{L}\{(f * g)(t)\} = F(s)G(s)$
$\mathcal{L}\{-tf(t)\} = F'(s)$	$\mathcal{L}\{t^n f(t)\} = (-1)^n F^{(n)}(s)$
$\mathcal{L}\left\{\frac{1}{t}f(t)\right\} = \int_s^\infty F(u) du$	$\mathcal{L}^{-1}\{F(s)\} = t\mathcal{L}^{-1}\left\{\int_s^\infty F(u) du\right\}$

- Set up the partial fractions for the following. (If you run out of things to be doing, work on the solutions).

(a)

$$\frac{1}{s^3(s-3)} =$$

(b)

$$\frac{3s^2 + 5}{(s^2 + 4s + 5)(s-2)} =$$

- Find the inverse Laplace transforms for the previous problems. (At least get the ones you know how to do!)

Lecture Problems

3. Find the inverse transforms using: $\mathcal{L} \left\{ \int_0^t f(u) \, du \right\} = \frac{1}{s} F(s)$.

(a)

$$\mathcal{L}^{-1} \left\{ \frac{1}{s-3} \right\} =$$

(b)

$$\mathcal{L}^{-1} \left\{ \frac{1}{s(s-3)} \right\} =$$

(c)

$$\mathcal{L}^{-1} \left\{ \frac{1}{s^2(s-3)} \right\} =$$

(d)

$$\mathcal{L}^{-1} \left\{ \frac{1}{s^3(s-3)} \right\} =$$

4. Find the inverse transforms using: $\mathcal{L} \{ e^{at} f(t) \} = F(s-a)$.

(a)

$$\mathcal{L}^{-1} \left\{ \frac{1}{(s-3)^2 + 9} \right\} =$$

(b)

$$\mathcal{L}^{-1} \left\{ \frac{s}{(s-3)^2 + 9} \right\} =$$

(c)

$$\mathcal{L}^{-1} \left\{ \frac{s+1}{s^2 + 4s + 5} \right\} =$$

(d)

$$\mathcal{L}^{-1} \left\{ \frac{2-3s}{4s^2 - 24s + 37} \right\} =$$

5. Homework problems (not to turn in, but you definitely should do these!). Solve the differential equations using Laplace

(a) $y'' + 2y' + 5y = 0, y(0) = 1, y'(0) = 2.$

(b) $y'' + 8y' + 25y = 0, y(0) = -1, y'(0) = 1.$