Final: "Study Guide"

Math 2410-004/013

April 25, 2018

The final exam is cumulative, but will focus more on recent material than that which has already been assessed. Specifically, 50% of the exam will be directly related to sections 4.1, 4.3, 4.4, 4.6 and 7.1 - 7.3. The remaining 50% will be split evenly between the content of exams 1 and 2.

As usual I have gathered a bank of questions from the recent sections that I intend to use to generate most of the exam. The questions on the exam will not match these *exactly* but will be of a similar form and content. Some exam questions may draw on more than one of these at a time.

The study guides for exam 1 and 2 apply for the other sections covered on the final.

I will generate the rest of the exam based upon ideas I emphasized in class, WebAssign, the written homework and homework questions not listed here.

You will be given a table of Laplace transforms similar to those two found on the following page.

If you have any questions, as always, let me know.

4.1: 4, 14

4.3: 23, 38, 58

4.4: 11, 29

4.6: 3, 9, 21

7.1: 3, 28, 31

7.2: 23, 38, 40

7.3: 9, 16, 29

The Laplace transform

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Recall that the Laplace transform of a function $f(t)$ is defined to be

$$\mathcal{L}[f(t)] = \int_0^\infty e^{-st} f(t)\, dt = F(s)$$

for all s such that the integral converges.

Below you will find a table of common Laplace transforms and inverse Laplace transforms. Further below is a table summarizing some of the properties of the Laplace transform.

$f(t) = \mathcal{L}^{-1}[F(s)]$	$F(s) = \mathcal{L}[f(t)]$	$f(t) = \mathcal{L}^{-1}[F(s)]$	$F(s) = \mathcal{L}[f]$
$f(t) = e^{at}$	$F(s) = \dfrac{1}{s-a}$ for $s > a$	$f(t) = t^n$	$F(s) = \dfrac{n!}{s^{n+1}}$ for $s > 0$
$f(t) = \sin(kt)$	$F(s) = \dfrac{k}{s^2+k^2}$	$f(t) = \cos(kt)$	$F(s) = \dfrac{s}{s^2+k^2}$
$f(t) = \mathcal{U}(t-a)$	$F(s) = \dfrac{e^{-as}}{s}$ for $(s > 0)$		

Rules for Laplace transforms	Rules for inverse Laplace transform
$\mathcal{L}[f'(t)] = s\mathcal{L}[f(t)] - f(0)$	
$\mathcal{L}[f''(t)] = s^2\mathcal{L}[f(t)] - sf(0) - f'(0)$	
$\mathcal{L}[af_1(t) + bf_2(t)] = a\mathcal{L}[f_1(t)] + b\mathcal{L}[f_2(t)]$	$\mathcal{L}^{-1}[aF_1(s) + bF_2(s)] = a\mathcal{L}^{-1}[F_1(s)] + b\mathcal{L}^{-1}[F_2(s)]$
$\mathcal{L}[e^{at}f(t)] = F(s-a)$	$\mathcal{L}^{-1}[F(s-a)] = e^{at}f(t)$
$\mathcal{L}[f(t-a)\mathcal{U}(t-a)] = e^{-as}F(s)$	$\mathcal{L}^{-1}[e^{-as}F(s)] = f(t-a)\mathcal{U}(t-a)$
$\mathcal{L}[g(t)\mathcal{U}(t-a)] = e^{-as}\mathcal{L}[g(t+a)]$	$\mathcal{L}^{-1}[e^{-as}F(s)] = f(t-a)\mathcal{U}(t-a)$