Math 2250-1
Fri 12/9
Review day

- Final exam is next Friday, 12/16 8-10:00 a.m. (You will be able to work until 10:20.)
- Chance to go over last spring's final exam next week.
  I suggest Wed 12/14 3-5 p.m.?

Chapters 1-2	10-20%	1st order DE's
3-4	20-30%	matrix algebra and vector space concepts
5	15-30%	linear DE's
6	15-30%	eigenvalues, eigenvectors } new since 2nd midterm.
7.	~~30~~ 40%	linear systems of DE's } new since 2nd midterm.
9	15-25%	non-linear systems of DE's } new since 2nd midterm.
10	15-25%	Laplace transform

(topics overlap, so percentages add up to more than 100%)

We'll discuss how the topics below are interconnected.

1-2 1st order DE's.
slope fields, phase portraits (for autonomous DE's)
equil. sol'ns
stability
$\exists!$ for IVP
methods:
separable
linear
applications
populations
vel-accel. models
tanks

3-4 Matrix alg/vector spaces
linear systems & matrices
rref
matrix algebra, manipulating matrix-vector equations
A^{-1}
$|A|$
vector spaces/subspaces
Linear dep/indep.
span
Basis
dimension
examples

5. Linear DE's
IVP $\exists!$
constant coeff DE's
basis of sol'ns for x_H ~ e^{rt}, Euler's formula
undetermined coeffs for x_p
applications to mechanical systems
damped/undamped; forced/unforced phenomena
amplitude/phase form of sinusoidal fcns
using TE = KE + PE for conservative systems

6. Eigenvalues & eigenvectors
A eigenbasis
(we won't consider defective matrices for final exam)
algebra for real and complex eigenvalues & eigenvectors

7. Linear systems of DE's.
$\vec{x}' = A\vec{x}$ $e^{\lambda t}\vec{v}$ bases
$\vec{x}' = A\vec{x} + \vec{f}(t)$, $\vec{x} = \vec{x}_p + \vec{x}_H$
$\vec{x}'' = A\vec{x}$ if A arises from conservative system
$\vec{x}'' = A\vec{x} + \cos\omega t\,\vec{b}$ $\cos\omega t\,\vec{v}$, $\sin\omega t\,\vec{v}$ bases
$\vec{x} = \vec{x}_p + \vec{x}_H$
natural IVP's, $\exists!$, dim of soln space for homog. linear systems.
equivalence of any DE or system & DE's to a 1st order system, and consequences
applications to input/output models & to multi-component mechanical systems

9. Nonlinear systems of DE's
autonomous systs of 2 1st order DE's
equil. sol'ns
stability
phase portraits
linearization near equilibria
population & mechanical system modelling

10. Laplace transform
def.
using table for $\mathcal{L}$, $\mathcal{L}^{-1}$
IVP's for linear DE's or systems via Laplace ~ often with partial fractions

We can probably touch on 70% of course concepts by studying these two DE's in as many ways as we can think of.

$$x'' + 5x' + 4x = 0 \qquad x'' + 5x' + 4x = 3\cos 2t$$