

Math 2250-4
 Wednesday 4/27
 Review day.

- Final exam is Wednesday May 4, 10:30 a.m. - 12:30 p.m. (you may work until 1:00)
- Regular problem sessions tomorrow.
- Chance to go over 2008 final exam tomorrow Thursday, LCB 225, 4-6 p.m. (this exam & soltns are posted - but remember to review and outline course concepts generally before focusing on specific review problems)

Chapters 1-2	10-20%	1 st order DE's	} new since 2 nd midterm.
3-4	20-30%	matrix algebra and vector space concepts	
5	15-30%	linear DE's	
6	15-30%	eigenvalues, eigenvectors	
7.	20-40%	linear systems of DE's	
9	15-25%	non-linear systems of DE's	
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'tns
- stability
- ∃! for IVP
- methods:
 - separable
 - linear
- applications:
 - populations
 - vel-accel. models
 - tanks

3-4 Matrix alg/vector spaces

- linear systems & matrices
- ref
- matrix algebra
- A⁻¹
- |A|
- vector spaces/subspaces
- linear dep/indep.
- span
- basis
- dimension
- examples

5. Linear DE's

- IVP ∃!
- constant coeff DE's
- basis of sol'tns 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 fcn's

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
- $\vec{x}' = A\vec{x} + \vec{f}(t)$
- $\vec{x}'' = A\vec{x}$ if A arises from conservative system
- $\vec{x}'' = A\vec{x}$ $\cos \omega t \vec{v}_1$, $\sin \omega t \vec{v}_2$ bases
- $\vec{x}'' = A\vec{x} + \cos \omega t \vec{b}$
- $\vec{x} = \vec{x}_p + \vec{x}_h$

- natural IVP's, ∃!, dim of sol'tn space for homog. linear systems.
- equivalence of any DE or system of 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 systems of 2 1st order DE's
- equil. sol'tns
- stability
- 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 ~ of fcn 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.

②

$$x'' + 5x' + 4x = 0$$

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