Math 2250-1
Friday Dec. 12
Review Day

Final Exam Tues. Dec. 16 8-10 a.m.
Here, ST 104

Practice Exam and solns is/will be posted

Review session Saturday (tomorrow)
11 a.m - 1 p.m JFB 103
(our Tuesday room)

Exam is comprehensive:

10-20% { 1.1-1.5 1st order DE's
2.1-2.3 applications, equilibria & stability

15-25% { 3.1-3.6 matrix algebra & determinants
4.1-4.5, 4.7 vector space concepts

15-25% { 5.1-5.6 linear DE's & spring applications

15-20% { 10.1-10.4 Laplace transforms, applications to DE's & DE systems

15-25% { 7.1-7.4 Linear systems of DE's; tank & spring systems, conversion from DE's to 1st order system

10-25% { 6.1-6.3 eigenvalues, eigenvectors, diagonalization; discrete dynamical systems

15-25% { 9.1-9.4 nonlinear systems of DE's, equilibria, stability, linearization, phase portraits, applications;

↑ topics overlap !!

Analytic solution methods for DE's & systems of DE's
- 1st order DE's: linear, separable
- higher order linear DE's: general soln = $x_H + x_p$,
  - how to find x_H, x_p for constant coeff DE's,
  - use of Euler's formula for complex exponentials,
  - applications to mass-spring problems
- eigenvalue, eigenvector methods, + matrix computations to find $\vec{x}_p(t)$ for
  - $\frac{d\vec{x}}{dt} = A\vec{x} + \vec{f}(t)$
  - $\frac{d^2\vec{x}}{dt^2} = A\vec{x} + \cos\omega t\, \vec{c}$
  - applications to tank & mass-spring systems.
- Laplace transforms to solve linear DE's or DE systems. → You will get xeroxes of the book covers, i.e. basic Laplace transforms and integrals.

Modeling: springs, spring systems, chapters 5, 7, 9
- compartmental analysis (tanks)
- population, velocity models, chpt 2
- interacting populations, chapter 9
- discrete dynamical systems, chapter 6

Geometric meaning for solns to DE's & systems of DE's (and resulting "theorems")
- slope fields, phase portraits, equilibrium solns, stability (chapter 2
- tangent vector fields (§7.1), phase portrait analysis & linearization, chapter 9
- existence/uniqueness for 1st order DE's or DE systems, or n^{th} order DE's
- dimension of solution space for homogeneous DE's or DE systems

Auxillary tools
- Linear algebra
  - new vocabulary, vector spaces, (in)dependence, span, dim, examples, etc.
  - solving linear systems, matrices, rref, matrix algebra, A^{-1}, dets, etc.
  - evals & evects
  - general sol'n to $L(x) = b$ when L is a linear operator: $x = x_p + x_H$
  - manipulating matrix & vector equations to find solutions to systems of DE's

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

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

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