

**NE 155, midterm 1 review S17**  
**March 3, 2017**

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Here are the topics we've covered and that are fair game for the exam.

The exam will be 50 minutes long and closed book.

You may use a calculator.

I will provide the notes sheet I'm handing out (and on the course site) with the exam for your use.

I encourage you to think about what can reasonably be asked about in 50 minutes if there are a few questions. Also think about what can be asked on an exam at all vs. what really requires a computer.

A goal of mine is for you to understand underlying principles and the meaning behind things. If you understand the meaning most other things will come out of it.

- Transport and diffusion equation
  - meaning of terms
  - assumptions in derivation
  - areas of applicability and validity
  - boundary and interface conditions
- Interpolation
  - what it is and what it's for
  - polynomial (Lagrange based): formula and error calculation
  - what we think about when evaluating interpolation quality
  - piecewise polynomials
- Approximation using least squares
  - what it is and what it's for
  - the normal equations
- Differentiation: Forming expressions for derivatives and their error terms using Taylor's theorem; orders of accuracy as a function of mesh size ( $O(h^x)$ )

- Integration
  - Lagrange form of Newton-Cotes
  - composite Newton-Cotes
  - both how you derive these rules and compute the errors
  - quality of integration
  - closed vs. open NC
- Vectors and properties
  - vector norms
  - measuring error and determining convergence
- Matrices and properties
  - how to compute a determinant; properties of determinants
  - matrix norms
  - eigenvalues, eigenvectors, and spectral radius
- Direct solutions of linear systems ( $A\vec{x} = \vec{b}$ )
  - diagonal, lower-tri and upper-tri systems
  - LU decomposition
  - tridiagonal systems