

NE 155, midterm 1 review S21
March 4, 2021

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

The exam will be takehome and open book.

You may use a calculator, wolfram alpha, or python/matlab.

You **must** submit all of your work, including wolfram alpha solves (screenshot it) or python, etc.

- 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