

# Math 375 Review Exam 2

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## • Interpolation

*Concepts.*

- How are polynomial interpolants to a given set of data  $(x_j, y_j), j = 1, \dots, n$  constructed?
- What is a cubic spline? How many unknowns? What are the determining equations?
- What is the Runge phenomena? what is Gibbs phenomenon? what are Chebishev points? in each case, give details/related information.

*Specific Skills.*

- Formulate the interpolation problem using the Vandermonde, Newton's and Lagrange's approach.
- Given a representation of an interpolant using a certain basis, find the coefficients that yield the interpolating function.
- State the formula for the interpolation error  $f(x) - p_n(x)$ , where  $p_n$  is the polynomial of degree  $n$  interpolating  $y_j = f(x_j), j = 0, \dots, n$ .
- Given a system of linear equations, write a MATLAB code to solve it by setting up the matrix  $A$  and using the backslash command.
- State the form of the trigonometric interpolant to  $n$  data points with period  $T$ .
- Find the Fourier coefficients for simple functions that are finite trigonometric polynomials.

## • Least Squares Approximations

*Concepts.*

- Describe a derivation of the normal equations. What can you say about the solution to these equations? What is the quantity that is minimized?

*Specific Skills.*

- Find the least squares solution of an overdetermined linear system.
- Find the overdetermined linear systems that determines the best least squares approximation of data by a line, a parabola, an exponential, etc.
- Find the residual error. Interpret it geometrically if applicable.