

Engineering and Science Mathematics 2B

Review for Midterm II

Wednesday, May 17, 8:15–9:30

Location:

- Students whose last names start with **A–F** take the exam in the **Research II Lecture Hall**.
- Students whose last names start with **G–Z** take the exam in the **Campus Center East Wing**.

Review Topics:

1. Inner products: Definition, examples, orthonormal basis, projections.
2. Gram-Schmidt orthonormalization.
3. Can you show that the eigenvectors of a symmetric (Hermitian) matrix are orthogonal provided the eigenvalues are distinct?
4. Can you show that the eigenvalues of a symmetric (Hermitian) matrix are real?
5. Review diagonalization and change of basis (as for the last midterm, but in particular in the context of symmetric or hermitian matrices and the corresponding orthonormal bases consisting of eigenvectors).
6. Fourier series (mainly complex case). Compute the Fourier series for easy examples (step function, low degree polynomials, sine and cosine function).
7. Interpretation of change between the complex Fourier series and Fourier cosine and sine series as a change of basis.
8. Basic properties of Fourier series (see, in particular, Homework 6 Questions 2 and 3).
9. Fourier transform: definition and computation of the Fourier transform for easy examples; basic properties. Can you give a direct proof of the Parseval theorem? Can you prove the convolution theorem?
10. Delta function: basic properties and simple computations.