

## Class schedule: Math 8530, Fall 2021

**Week 1: 8/18–8/20.** Course overview (all Wednesday). One lecture on Friday on Section 1 slides, p. 1–11. Corresponding YouTube videos:

- Lecture 1.1: Vector spaces and linearity
- Lecture 1.2: Spanning, independence, and bases (0:00–32:50)

**Week 2: 8/23–8/27.** HW 1 due Friday. Three in-class lectures. Corresponding YouTube videos:

- Lecture 1.2: Spanning, independence, and bases (32:50–39:25).
- Lecture 1.3: Direct sums and products
- Lecture 1.4: Quotient spaces
- Lecture 1.5: Dual vector spaces

*For Monday:* Watch Lecture 1.6: Annihilators.

**Week 3: 8/30–9/3.** HW 2 due Friday (extended to Sunday). Corresponding YouTube videos:

- Lecture 2.1: Rank and nullity
- Lecture 2.2: Applications of the rank-nullity theorem
- Lecture 2.3: Algebra of linear maps
- Lecture 2.4: The four subspaces (0:00–31:11)

**Week 4: 9/6–9/10.** HW 3 due Friday. Three lectures.

- Lecture 2.5: The transpose of a linear map
- Lecture 2.6: Matrices
- Lecture 2.7: Change of basis
- Lecture 3.1: Determinant prerequisites (0:00–15:04)

**Week 5: 9/13–9/17.** HW 4 due Friday. Three lectures.

- Lecture 3.1: Determinant prerequisites (15:05–27:10)
- Lecture 3.2: Symmetric and skew-symmetric multilinear forms
- Lecture 3.3: Alternating multilinear forms

**Week 6: 9/20–9/24.** HW 5 due Friday (extended to Sunday). Two lectures. Friday spent going over homework.

- Lecture 3.4: Determinants of linear maps
- Lecture 3.5: The determinant and trace of a matrix
- Lecture 3.6: Minors and cofactors (0:00–25:06)

**Week 7: 9/28–10/2.** HW 6 due Friday. Two lectures, Monday and Friday. Wednesday spent going over HW 6. Midterm 1 next Monday.

- Lecture 3.6: Minors and cofactors (25:07–31:33)
- Lecture 3.7: Tensors (watch on your own time)
- Lecture 4.1: Eigenvalues and eigenvectors

*For this Wednesday:* Watch Lecture 3.7: Tensors, and come to class with questions on HW 6.

*For next Wednesday:* Watch Lecture 4.2: The Cayley-Hamilton theorem.

**Week 8: 10/4–10/8.** Midterm 1 Monday. HW 7 due Friday. Two lectures.

- Lecture 4.3: Generalized eigenvectors
- Lecture 4.4: Invariant subspaces
- Lecture 4.5: The spectral theorem (0:00–6:21).

**Week 9: 10/11–10/15.** No class Monday (Fall Break). HW 8 due Friday. Two lectures.

- Lecture 4.5: The spectral theorem (6:21–32:59)
- Lecture 4.6: Generalized eigenspaces
- Lecture 4.7: Jordan canonical form

**Week 10: 10/18–10/22.** Three lectures. HW 9 due Friday.

- Lecture 4.8: Generalized eigenvectors of differential operators
- Lecture 5.1: Inner products and Euclidean space

**Week 11: 10/25–10/29.** Three lectures. HW 10 due Friday.

- Lecture 5.2: Orthogonality
- Lecture 5.3: Gram-Schmidt and orthogonal projection
- Lecture 5.4: Adjoints
- Lecture 5.5: Projection and least squares (0:00–11:09)

**Week 12: 11/1–11/5.** Two lectures. Midterm 2 Friday. HW 11 due Friday.

- Lecture 5.5: Projection and least squares (11:10–36:31)
- Lecture 5.8: Sequences and convergence

*For next Monday:* Watch Lecture 5.7: The norm of a linear map.

**Week 13: 11/8–11/12.** Three lectures. HW 12 due Friday (extended until Monday).

- Lecture 5.9: Complex inner product spaces
- Lecture 6.1: Quadratic forms
- Lecture 6.2: Spectral resolutions
- Lecture 6.3: Normal linear maps

**Week 14: 11/15–11/19.** Three lectures. HW 13 due next Tuesday.

- Lecture 6.4: The Rayleigh quotient
- Lecture 6.5: Self-adjoint differential operators
- Lecture 7.1: Definiteness and indefiniteness
- Lecture 7.2: Nonstandard inner products and Gram matrices (0:00–32:29).

**Week 15: 11/22–11/26.** One lecture. Thanksgiving break Wed–Fri. HW 13 due Tuesday.

- Lecture 7.3: Polar decomposition

**Week 16: 11/29–12/3.** Three lectures. HW 14 due Friday.

- Lecture 7.4: Singular value decomposition
- Lecture 7.5: The partial order of positive maps
- Lecture 7.6: Monotone matrix functions