

# Mathematics 221

## LINEAR ALGEBRA & APPLICATIONS

### Syllabus

This syllabus is based on a Monday, Wednesday, Friday schedule.

All section numbers and homework problems are from the text,  
*Linear Algebra: A Geometric Approach* (second edition),  
 by Theodore Shifrin and Malcolm R. Adams.

<i>Lesson number</i>	<i>Section number</i>	<i>Topic / Homework</i>
1	1.1	Vectors HW, pp. 15–18: 6(a,c,g), 7, 8, 10, 11, 21, 22, 23, 25, 29
2	1.2	Dot Products HW, pp. 25–28: 1(b,d,g), 2(b,d,g), 4, 9, 11, 13 (no geometric interpretation necessary), 16, 18
3	1.3	Hyperplanes in $\mathbb{R}^n$ HW, pp. 34–35: 1(a,c,f), 3(a,d,e), 5, 8, 10, 12
4	1.4	Systems of Linear Equations and Gaussian Elimination, Part 1
5	1.4	Systems of Linear Equations and Gaussian Elimination, Part 2 HW, pp. 49–53: 1, 3(a–f), 4(d,f), 10, 11, 13
6	1.5	Theory of Linear Systems, Part 1
7	1.5	Theory of Linear Systems, Part 2 HW, pp. 61–64: 1, 2(a,b), 3(a,c), 4a, 5b, 6, 10, 12, 13, 14
8	1.6	Some Applications HW, pp. 75–77: 3, 5, 7, 9, 11, 12a, 13b
9	2.1	Matrix Operations HW, pp. 89–91: 1(a,c,f), 2, 5, 6, 7, 8, 9, 12(a,b,d), 14, 15
10	2.2	Linear Transformations HW, pp. 100–102: 5, 7, 8
11	2.3	Inverse Matrices HW, pp. 108–110: 1(b,d,f), 2(a,c,d), 4, 8, 11, 12, 16
12	2.4	Elementary Matrices HW, pp. 118–119: 3(a,c,d), 7, 14
13	2.5	The Transpose HW, pp. 122–124: 1(a,f,j), 4, 8, 9, 12, 15, 19(a,b,c), 22, 23
14	3.1	Subspaces of $\mathbb{R}^n$ HW, pp. 134–135: 1, 2(a,c,d), 6, 9(b,c), 10, 12, 13, 14, 17
15	3.2	The Four Fundamental Subspaces

		HW, pp. 142-143: 1, 2(a,b), 5, 10, 11
16	3.3	Linear Independence HW, pp. 154–156: 1, 2, 5(a,b), 8, 10, 11, 14, 15, 19, 21, 22
17		Quiz
18	3.4	Dimension, Part 1
19	3.4	Dimension, Part 2 HW, pp. 167–170: 2, 3(a,b,d), 4, 7, 17, 20, 24
20	3.6	Abstract Vector Spaces, Part 1
21	3.6	Abstract Vector Spaces, Part 2 HW, pp. 185–188: 1, 2(a,c,d), 3(a,c,f), 4, 6(a,b), 9, 12a, 13, 14(b,c), 15(a,b)
22		Complex Vector Spaces, $\mathbb{C}^n$ and related topics
23	4.1	Inconsistent Systems and Projection HW, pp. 198–200: 1(a,b), 3, 6, 7, 9, 11, 13, 15
24	4.2	Orthogonal Bases, Part 1
25	4.2	Orthogonal Bases, Part 2 HW, pp. 206–208: 2(b,c), 3, 6, 7(a,b), 8a, 9a, 11, 12(a,b)
26	4.3	The Matrix of a Linear Transformation, Part 1
27	4.3	The Matrix of a Linear Transformation, Part 2 HW, pp. 220–224: 3, 7, 9, 12, 16, 18, 19, 20, 21
28	4.4	Abstract Linear Transformations HW, pp. 234–237: 2, 5, 7, 8, 11, 21
29	5.1	Determinants HW, pp. 243–245: 1(a,b,c), 2, 3, 4, 7, 9a, 10, 11
30	5.2	Cofactors and Cramer's Rule HW, pp. 252–255: 1a, 3, 4, 5(a,c,f), 7, 8, 10
31	5.3	Signed Area and Volumes HW, pp. 258–260: 3, 5, 7
32		Quiz
33	6.1	The Characteristic Polynomial HW, pp. 268–270: 1(a,b,d,g,h,i,p), 2, 3, 4, 6, 7(a,d), 9, 10, 13(a,b)
34	6.2	Diagonalizability HW, pp. 274–277: 1(a,b,d,g,h,i,p), 2(c,e,f), 4, 7, 8, 11, 12, 13, 15, 17a, 19(a,b)
35	6.3	Applications HW, pp. 284–285: 1, 2, 3, 8, 11, 12a
36	6.4	The Spectral Theorem, Part 1
37	6.4	The Spectral Theorem, Part 2 HW, pp. 294–296: 1(a,d,e,g), 3, 5, 7, 12(a,b,c,d), 14

38	7.1	Complex Eigenvalues and Jordan Canonical Form, Part 1
39	7.1	Complex Eigenvalues and Jordan Canonical Form, Part 2 HW, pp. 312-314: 1, 2(a,b,c,e), 4, 5, 7(a,b,c), 8(a,c,e), 14, 16
40	7.3	Matrix Exponentials and Differential Equations, Part 1
41	7.3	Matrix Exponentials and Differential Equations, Part 2 HW, pp. 344-347: 1(a,c,d), 2(a,b,d), 4, 5(a,b), 6, 8(only for $n = 3$ ), 9(a,b), 10, 13, 14
42		Quiz

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