

# Math 115AB: Linear Algebra

- Math 115A: General Course [Information](#) and [Outline](#)
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## Catalog Description

**115A. Linear Algebra. (5)** Lecture, three hours; discussion, two hours. Prerequisite: course 33A. Techniques of proof, abstract vector spaces, linear transformations, and matrices; determinants; inner product spaces; eigenvector theory. P/NP or letter grading.

**115B. Linear Algebra. (4)** Lecture, three hours; discussion, one hour. Prerequisite: course 115A. Linear transformations, conjugate spaces, duality; theory of a single linear transformation, Jordan normal form; bilinear forms, quadratic forms; Euclidean and unitary spaces, symmetric skew and orthogonal linear transformations, polar decomposition. P/NP or letter grading.

## Additional Information

Math 115A is a core mathematics course required of all the various mathematics majors. The course material can be regarded as an elaboration of the linear algebra already covered in Math 33A. However, the level of abstraction and the emphasis on proof technique make this a difficult course for many students. Successful students emerge from the experience not only with a better understanding of linear algebra, but also with a higher level of mathematical maturity, better equipped to deal with abstract concepts.

The material covered in Math 115A includes linear independence, bases, orthogonality, the Gram-Schmidt process, linear transformations, eigenvalues and eigenvectors, and diagonalization of matrices. These topics are all covered in Math 33A though only in the context of Euclidean space. Topics in Math 115A that go beyond Math 33A include inner product spaces, adjoint transformations, and the spectral decomposition theorem for self-adjoint operators.

Three or four sections of Math 115A are offered each term. Also, an honors version Math 115AH runs parallel to Math 115A in some quarters. The content of Math 115AH is as follows: Vector spaces, subspaces, basis and dimension, linear transformations and matrices, rank and nullity, change of basis and similarity of matrices, inner product spaces, orthogonality and orthonormality, Gram-Schmidt process, adjoints of linear transformations and dual spaces, quadratic forms and symmetric matrices, orthogonal and unitary matrices, diagonalization of hermitian and symmetric matrices, eigenvectors and eigenvalues, and their computation, exponentiation of matrices and application to differential equations, least squares problems, trace, determinant, canonical forms. Systems of linear equations: solvability criteria, Gaussian elimination, row-reduced form, LU decomposition.

## Recent Enrollment Statistics

Recent enrollment statistics for Math 115A (excluding Math 115AH) are given in the following table:

Year	Fall	Winter	Spring
1993-1994	126 (4 sections)	98 (4 sections)	114 (3 sections)
1994-1995	134 (4 sections)	144 (4 sections)	111 (4 sections)
1995-1996	135 (4 sections)	122 (4 sections)	121 (4 sections)
1996-1997	132 (4 sections)	107 (4 sections)	96 (3 sections)
1997-1998	142 (4 sections)	108 (4 sections)	100 (3 sections)

1998-1999	110 (4 sections)	110 (4 sections)	118 (3 sections)
1999-2000	151 (4 sections)	103 (4 sections)	111 (3 sections)
2000-2001	146 (4 sections)	101 (3 sections)	124 (4 sections)
2001-2002	106 (3 sections)	153 (4 sections)	93 (3 sections)
2002-2003	140 (4 sections)	142 (4 sections)	112 (3 sections)
2003-2004	146 (4 sections)	156 (4 sections)	(3 sections)

The material covered in Math 115B may vary, though it always includes normal forms for matrices and the Jordan canonical form. Math 115B is a sequel to Math 115A.

Recent enrollment statistics for Math 115B are given in the following table:

<b>Year</b>	<b>Fall</b>	<b>Winter</b>	<b>Spring</b>
1993-1994	(no sections)	(no sections)	(no sections)
1994-1995	(no sections)	(no sections)	(no sections)
1995-1996	(no sections)	(no sections)	(no sections)
1996-1997	(no sections)	29 (1 section)	no sections
1997-1998	(no sections)	(no sections)	(no sections)
1998-1999	(no sections)	21 (1 section)	(no sections)
1999-2000	(no sections)	(no sections)	(no sections)
2000-2001	(no sections)	(no sections)	25 (1 section)
2001-2002	(no sections)	(no sections)	(no sections)
2002-2003	(no sections)	(no sections)	24 (1 section)
2003-2004	(no sections)	(no sections)	(1 section)