

Fill-In Guide 1 for Linear Algebra—Bring to Classes

Material in this class builds on itself so try to fill in the relevant items below as we cover them to help you internalize them and provide you with a working guide that you can use to help with activities such as handwrites, group reviews, and group debriefs during class as well as activities out of class such as practice quizzes, card sorts, problem sets and studying for exams.

I want you to understand and solidify and I'm happy to help in and out of class!

topic	first appeared	..... item numbers below
algebraic manipulations of equations by-hand	prior classes	..... 1
associativity	module 2 in 2.1	..... 43
augmented matrix	module 1 in 1.1	..... 2–4, 6, 11, 26–27
back substitution	module 1 in 1.2	..... 4
column space	module 2 in 2.8	..... 44–45
consistency and inconsistency	module 1 in 1.2	..... 5–6
determinant of 2×2 matrix	module 2 in 2.2	..... 46
elementary matrix	module 2 in 2.2	..... 48
free	module 1 in 1.2	..... 8, 26–30
generic vector	module 1 in 1.4	..... 12, 37–38
geometry of parameterizations	module 1 in 1.5	..... 28–30
Gaussian to row echelon form	module 1 in 1.2	..... 9
homogeneous	module 1 in 1.5	..... 10–11
identity matrix	module 2 in 2.1	..... 49, 51
inverse of a 2×2 matrix	module 2 in 2.2	..... 50
invertible matrix theorem	module 2 in 2.3	..... 51–52
linear combinations of vectors and geometry	module 1 in 1.3	..... 13–19
linear independence	module 1 in 1.7	..... 20–21, 32–33, 51
matrix multiplication	module 2 in 2.1	..... 53–54
matrix-vector multiplication	module 1 in 1.4	..... 22–24, 51
null space	module 2 in 2.8	..... 55–56
rank, nullity and dimension	module 2 in 2.9	..... 47, 57–60
overdetermined and underdetermined	module 1 in 1.2	..... 25
pivots	module 1 in 1.2	..... 21, 31–33
parameterized vector form solutions	module 1 in 1.5	..... 14–17, 26–30
replacement	module 1 in 1.1	..... 9, 34
row equivalent	module 1 in 1.1	..... 35, 51
singular matrix	module 2 in 2.2	..... 61
span	module 1 in 1.3	..... 32–33, 36–38
standard mathematical axes and plots	prior classes and 1.3	..... 7, 39–40
subspace	module 2 in 2.8	..... 62
transpose of a matrix	module 2 in 2.1	..... 63
trivial solution	module 1 in 1.5	..... 20, 41
unique solution	module 1 in 1.1	..... 42

Module 1 and Related Items from Prior Classes

- 1) algebraic manipulations of equations by-hand such as rewrite an equation to solve for one variable in terms of others by putting them on the other side and dividing by a coefficient—example

- 11) homogeneous system—example of an augmented matrix

- 12) generic vector—example

- 13) geometry of $\vec{u} + \vec{v}$ —example of a sketch that includes original vectors that are not on the same line

- 14) geometry of $t\vec{u}$ —example of a sketch that includes the original vector

- 15) geometry of $t\vec{u} + \vec{v}$ —example of a sketch that includes original vectors that are not on the same line

- 16) geometry of $s\vec{u} + t\vec{v}$ —example of a sketch that includes original vectors that are not on the same line

- 17) line parallel to \vec{v}_1 through the tip of \vec{v}_2 —expression

- 18) linear combination—definition

- 19) linear combination weights—example

- 20) linear independence of $\{v_1, v_2, \dots, v_k\}$ —definition

- 21) linear independence of $\{v_1, v_2, \dots, v_k\}$ —how to check using column pivots after augmenting with $\vec{0}$
- 22) matrix-vector equation—example
- 23) multiply a matrix by a column vector—example using dot products
- 24) multiply a matrix by a column vector—example using linear combinations
- 25) overdetermined and underdetermined systems—examples
- 26) parametric vector form with 1 free variable from a reduced augmented matrix—example of solving
- 27) parametric vector form with 2 free variables from a reduced augmented matrix—example of solving
- 28) parametric vector form—geometry with 1 free variable
- 29) parametric vector form—geometry with 2 free variables

- 30) parametric vector form—geometry with 3 free variables
- 31) pivots and pivot columns—example
- 32) pivots are full for the columns—relationship to linear independence or spanning all of \mathbb{R}^n (which?)
- 33) pivots are full for the rows—relationship to linear independence or spanning all of \mathbb{R}^n (which?)
- 34) replacement—example
- 35) row equivalent—meaning
- 36) span of $\{v_1, v_2, \dots, v_k\}$ —definition
- 37) span of $\{v_1, v_2, \dots, v_k\}$ is all of \mathbb{R}^n —how to check using a generic vector and row pivots
- 38) span of $\{v_1, v_2, \dots, v_k\}$ —when not all of \mathbb{R}^n , how to find an equation of vectors in the span using a generic vector
- 39) standard mathematical axes \vec{x} to right and \vec{y} up—example with the axes and a vector plotted

40) standard mathematical axes \vec{x} pointed out of board, \vec{y} to right, and \vec{z} up—example with the axes and a vector plotted

41) trivial solution—definition

42) unique solution—definition

Module 2 and Related Items (Some Related Items are Above)

43) associativity for multiplication—algebraic condition

44) column space of A—definition

45) column space of A—example of solving for the entire space as well as a basis

46) determinant of $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$

47) dimension of a subspace—definition

48) elementary matrix—example of replacement

49) identity matrix for multiplication—example of matrix

50) inverse of $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$

51) invertible matrix theorem—theorem statements in 2.3

52) invertible matrix theorem—theorem statements in 2.9

53) multiply two matrices via using A times each column of B —example

54) multiply two matrices via dot products—example

55) null space of A —definition

56) null space of A —example of solving for the entire space as well as a basis

57) nullity of a matrix—definition

58) rank of a matrix—definition

59) rank-nullity theorem—statement

60) rank-nullity theorem—example

61) singular matrix—definition

62) subspace—definition

63) transpose of a matrix—example