

## Jeff Anderson's Applied Linear Algebra Playlists

Below is a list of YouTube playlists that I created as supplementary materials for my Math 2B course. You can find these, and many other additional resources, that I provide to my students on my Math 2B course homepage:

<http://www.appliedlinearalgebra.com/blog/for-students/welcome-to-math-2b>

I provide links to both the playlists and the individual videos found within. I also show the length of each video.

Finally, the column labeled “Complete” is a great place to track your progress through these videos. I recommend that you track the amount of time you spend watching each video in that column. If you are taking notes and struggling in productive ways to understand the concepts in each video, I bet that you’ll spend more time than the length of each video (my bet is that the ratio is somewhere between 2 and 4: you’ll spend 2X – 4X the amount of time watching each video than the length of the video itself).

The best way to figure out how long it takes you to watch this content is to track your work. If you get in this habit early in the class, you’ll collect a lot of data to help guide your guesses about how long it takes you to watch these videos and take notes on the content. One of the most difficult aspects of learning in college is [accurately predicting how much time it takes to learn](#) material. By systematically tracking your progress, you’ll build insights into that larger question.

MATH 2B, Lesson 0

[Fundamental Problems of Applied Linear Algebra](#)

(8 Videos: 1h, 20m, 23s)

Video Title	Length	Complete
1. <a href="#">What is the Applied Math Modeling Problem</a>	16m, 38s	
2. <a href="#">Three Pillars of Applied Math</a>	4m, 33s	
3. <a href="#">What is the Matrix-Vector Multiplication Problem</a>	7m, 03s	
4. <a href="#">What is the Nonsingular Linear-Systems Problem</a>	5m, 46s	
5. <a href="#">What are the three most fundamental problems in linear algebra?</a>	18m, 23s	
6. <a href="#">What is the General Linear-Systems Problem?</a>	3m, 19s	
7. <a href="#">What quadratic equations teach us about general linear systems?</a>	11m, 07s	
8. <a href="#">What are the three types of solutions to general linear systems?</a>	13m, 34s	

## MATH 2B, Lesson 1

[Introduction to Set Theory](#)

(12 Videos: 1h, 04m, 54s)

Video Title	Length	Complete
1. <a href="#">Introduction to Set Theory</a>	4m, 8s	
2. <a href="#">Definition of Set</a>	3m, 13s	
3. <a href="#">Define Sets via Enumeration</a>	4m, 46s	
4. <a href="#">Element Inclusion and Truth Values</a>	6m, 59s	
5. <a href="#">Example 3 Stanley's Brace Notation</a>	3m, 9s	
6. <a href="#">Set Builder Notation</a>	3m, 19s	
7. <a href="#">Example of Set Builder Notation</a>	3m, 28s	
8. <a href="#">Definition of Famous Number Systems</a>	7m, 27s	
9. <a href="#">Definition of Subsets</a>	7m, 27s	
10. <a href="#">Subset Proof</a>	6m, 41s	
11. <a href="#">Definition of Set Equality</a>	4m, 54s	
12. <a href="#">Example of Proving Set Equality</a>	7m, 45s	

## MATH 2B, Lesson 2

[Relations and Functions](#)

(10 Videos: 54m, 30s)

Video Title	Length	Complete
1. <a href="#">Why do we care about codomain in Linear Algebra</a>	14m, 07s	
2. <a href="#">Definition of cross product of sets</a>	2m, 28s	
3. <a href="#">Example of cross product of sets for voting map</a>	2m, 29s	
4. <a href="#">Example of cross product of sets for lexicographical ordering</a>	1m, 49	
5. <a href="#">Set theory definition of relation between sets</a>	5m, 12s	
6. <a href="#">Dial pad relation</a>	5m, 36s	
7. <a href="#">Definition of domain and range</a>	7m, 56s	
8. <a href="#">Example of domain and range for dial pad relation</a>	2m, 58s	
9. <a href="#">Example of domain and range for ellipse relation</a>	3m, 29s	
10. <a href="#">Set theoretic definition of a function</a>	8m, 30s	

## MATH 2B, Lesson 3

[Vector Modeling](#)

(6 Videos: 57m, 38s)

Video Title	Length	Complete
1. <a href="#">Introduction to and definition of a column vector</a>	6m, 36s	
2. <a href="#">Hooke's law experiment set up</a>	10m, 21s	
3. <a href="#">Hooke's law experiment data set</a>	5m, 8s	
4. <a href="#">Example of vector model for grades in math class</a>	6m, 46s	
5. <a href="#">Example of 2-mass, 3-spring chain set up</a>	22m, 50s	
6. <a href="#">Mathematize the 2-mass, 3-spring chain</a>	5m, 57s	

## MATH 2B, Lesson 4

[Vector Arithmetic](#)

(10 Videos: 1h, 23m, 25s)

Video Title	Length	Complete
1. <a href="#">Introduction to vector arithmetic</a>	1m, 22s	
2. <a href="#">Definition of scalar-vector multiplication</a>	5m, 43s	
3. <a href="#">Example of Hooke's law experiment spring forces</a>	6m, 4s	
4. <a href="#">Geometric interpretation of scalar-vector multiplication</a>	9m, 35s	
5. <a href="#">Definition of column vector addition</a>	6m, 56s	
6. <a href="#">Example of the geometry of vector addition</a>	12m, 4s	
7. <a href="#">Example of vector arithmetic in mass-spring chain</a>	8m, 17s	
8. <a href="#">Example of vector arithmetic in Hooke's law</a>	12m, 43s	
9. <a href="#">Algebraic properties of vector arithmetic</a>	14m, 5s	
10. <a href="#">Vector transpose with algebraic properties</a>	6m, 36s	

## MATH 2B, Lesson 5

[Inner Products and Vector Norms](#)

(16 videos: 2h, 23m, 44s)

Video Title	Length	Complete
1. <a href="#">Definition of inner product between column vectors</a>	3m, 13s	
2. <a href="#">Example of inner product to calculate grades</a>	1m, 40s	
3. <a href="#">Algebraic properties of the inner product</a>	3m, 52s	
4. <a href="#">Proof of linearity in left argument of inner product in <math>\mathbb{R}^n</math></a>	5m, 21s	
5. <a href="#">Definition of 2-norm in <math>\mathbb{R}^n</math></a>	8m, 46s	
6. <a href="#">Algebraic properties of the 2-norm in <math>\mathbb{R}^n</math></a>	2m, 45s	
7. <a href="#">Proof of positivity of the 2-norm in <math>\mathbb{R}^n</math></a>	5m, 16s	
8. <a href="#">Proof of homogeneity of the 2-norm in <math>\mathbb{R}^n</math></a>	12m, 0s	
9. <a href="#">Pre-requisite review for cosine formula of inner product</a>	7m, 40s	
10. <a href="#">Proof of Pythagorean theorem</a>	8m, 54s	
11. <a href="#">Proof of acute case of law of cosines</a>	9m, 59s	
12. <a href="#">Proof of obtuse case of law of cosines</a>	14m, 54s	
13. <a href="#">Proof of cosine formula for inner product</a>	22m, 6s	
14. <a href="#">Geometric intuition from cosine formula for inner product</a>	10m, 32s	
15. <a href="#">Direction versus orientation of a vector</a>	13m, 18s	
16. <a href="#">Proof of triangle inequality for the 2-norm in <math>\mathbb{R}^n</math></a>	13m, 28s	

## Lesson 6

[Span and Linear Independence](#)

(20 Videos: 1h, 59m, 00s)

Video Title	Length	Complete
1. <a href="#">Definition of linear combinations in <math>\mathbb{R}^n</math></a>	9m, 06s	
2. <a href="#">More about linearity</a>	3m, 21s	
3. <a href="#">Example 1 of linear combinations</a>	8m, 46s	
4. <a href="#">Example 2 of linear combinations</a>	15m, 34s	
5. <a href="#">Example 3 of linear combinations</a>	7m, 02s	
6. <a href="#">Example 4 of linear combinations</a>	5m, 46s	
7. <a href="#">Definition of span in <math>\mathbb{R}^n</math></a>	5m, 20s	
8. <a href="#">Example 1 of span of vectors</a>	2m, 27s	
9. <a href="#">Example 2 of span of vectors</a>	9m, 08s	
10. <a href="#">Definition 1 of linear dependence in <math>\mathbb{R}^n</math></a>	4m, 2s	
11. <a href="#">Definition 2 of linear dependence in <math>\mathbb{R}^n</math></a>	4m, 53s	
12. <a href="#">Example 1 of linear dependence</a>	6m, 29s	
13. <a href="#">Example 2 of linear dependence</a>	8m, 38s	
14. <a href="#">Definition of linearly dependent set of vectors in <math>\mathbb{R}^n</math></a>	5m, 19s	
15. <a href="#">Example 1 of linearly dependent set</a>	2m, 26s	
16. <a href="#">Test for linear dependence in <math>\mathbb{R}^n</math></a>	6m, 15s	
17. <a href="#">Example 1 of test for linear dependence</a>	4m, 24s	
18. <a href="#">Example 2 of test for linear dependence</a>	3m, 44s	
19. <a href="#">Definition of linear independence</a>	3m, 16s	
20. <a href="#">Example 1 of linear independence</a>	3m, 04s	

MATH 2B, Lesson 7

[Matrix Modeling](#)

(9 videos: 1h, 41m, 01s)

Video Title	Length	Complete
1. <a href="#">Concept diagram for linear algebraic operations</a>	15m, 17s	
2. <a href="#">Entry-by-entry definition of a matrix</a>	6m, 25s	
3. <a href="#">What's in an entry?</a>	2m, 08s	
4. <a href="#">Wireframe model in 2D</a>	7m 41s	
5. <a href="#">Wireframe model in 3D</a>	8m, 46s	
6. <a href="#">Polygon model in 3D</a>	8m, 36s	
7. <a href="#">Adjacency matrix for undirected graphs</a>	15m, 08s	
8. <a href="#">Adjacency matrix for directed graphs</a>	21m, 08s	
9. <a href="#">Digital image matrices</a>	15m, 22s	

## MATH 2B, Lesson 8

[Anatomy of Matrices](#)

(18 Videos: 1h, 38m, 47s)

Video Title	Length	Complete
1. <a href="#">Introduction to matrix anatomy</a>	09m, 59s	
2. <a href="#">Example 1 of matrix anatomy</a>	04m, 51s	
3. <a href="#">Definition of the leading entries of a row</a>	05m, 32s	
4. <a href="#">Definition of sparse matrices</a>	04m, 56s	
5. <a href="#">Special sparsity structure notation</a>	08m, 48s	
6. <a href="#">Definition of diagonal matrices</a>	03m, 04s	
7. <a href="#">Definition of n-by-n identity matrix</a>	02m, 18s	
8. <a href="#">Definition of lower-triangular matrix</a>	11m, 17s	
9. <a href="#">Introduction to outer products</a>	04m, 01s	
10. <a href="#">Introduction to column and row partitions</a>	03m, 15s	
11. <a href="#">Introduction to colon notation for the columns of a matrix</a>	05m, 57s	
12. <a href="#">Definition of the column operator</a>	01m, 31s	
13. <a href="#">The column partition of a matrix</a>	05m, 35s	
14. <a href="#">When to use column partitions of a matrix</a>	07m, 53s	
15. <a href="#">Colon notation for the rows and the row operator</a>	04m, 55s	
16. <a href="#">The row partition of a matrix</a>	02m, 30s	
17. <a href="#">When to use row partitions of a matrix</a>	09m, 50s	
18. <a href="#">Column and row partition of the identity matrix</a>	02m, 35s	

## MATH 2B, Lesson 9

[Matrix Arithmetic](#)

(18 Videos: 1h, 57m, 33s)

Video Title	Length	Complete
1. <a href="#">Definition of the outer product between vectors</a>	05m, 21s	
2. <a href="#">Example of matrix units as outer products</a>	06m, 26s	
3. <a href="#">Example of Gauss transform as an outer product</a>	02m, 22s	
4. <a href="#">Why do we use column vectors so much?</a>	02m, 16s	
5. <a href="#">Scalar-matrix multiplication</a>	04m, 36s	
6. <a href="#">Matrix-matrix addition</a>	04m, 41s	
7. <a href="#">Example of identity as matrix-matrix addition problem</a>	03m, 00s	
8. <a href="#">Write any matrix as a linear combination of outer products</a>	02m, 02s	
9. <a href="#">Example of matrix addition in computational photography</a>	03m, 14s	
10. <a href="#">Algebraic Properties of Matrix Arithmetic</a>	01m, 42s	
11. <a href="#">Definition of a rank-one update</a>	03m, 49s	
12. <a href="#">Definition and examples of shear matrices</a>	11m, 50s	
13. <a href="#">Definition and examples of dilation matrices</a>	11m, 27s	
14. <a href="#">Definition and examples of transposition matrices</a>	21m, 26s	
15. <a href="#">Example of transposition matrix</a>	09m, 53s	
16. <a href="#">Definition and examples of Gauss transforms</a>	09m, 46s	
17. <a href="#">Definition of the transpose of a matrix</a>	11m, 22s	
18. <a href="#">Algebraic properties of the transpose</a>	02m, 19s	



Lesson 10:

[Matrix-Vector Multiplication](#)

(12 Videos: 2h, 45m, 32s)

Video Title	Length	Complete
1. <a href="#">Matrix-vector multiplication via column partition</a>	15m, 20s	
2. <a href="#">Matrix-vector multiplication via row partition</a>	15m, 50s	
3. <a href="#">Matrix-vector multiplication via individual entries</a>	10m, 18s	
4. <a href="#">The mathematician and her coffee pot</a>	08m, 08s	
5. <a href="#">Review of products in linear algebra</a>	17m, 02s	
6. <a href="#">The elongation vector for a mass-spring chain</a>	20m, 08s	
7. <a href="#">The net force vector for a mass-spring chain</a>	08m, 36s	
8. <a href="#">Net internal spring force vector for a mass-spring chain</a>	18m, 34s	
9. <a href="#">Transform a mass-spring chain into matrix multiplication</a>	13m, 12s	
10. <a href="#">Derivation of givens rotations</a>	15m, 11s	
11. <a href="#">Example of Gauss transforms in action</a>	14m, 32s	
12. <a href="#">Algebraic properties of matrix-vector multiplication</a>	08m, 41s	

Lesson 11:

[Matrix-Matrix Multiplication](#)

(16 Videos: 2h, 24m, 01s)

Video Title	Length	Complete
1. <a href="#">Introduction to matrix-matrix multiplication</a>	5m, 13s	
2. <a href="#">Anatomy of matrix-matrix multiplication</a>	10m, 57s	
3. <a href="#">Definition of conformable for multiplication of matrices</a>	6m, 1s	
4. <a href="#">Right matrix-matrix multiplication via columns</a>	20m, 30s	
5. <a href="#">Example of dilation in right matrix multiplication</a>	10m, 24s	
6. <a href="#">Example of transposition in right matrix multiplication</a>	7m, 22s	
7. <a href="#">What up with the words <i>active</i> and <i>passive</i></a>	5m, 55s	
8. <a href="#">Left matrix-matrix multiplication via rows</a>	18m, 17s	
9. <a href="#">Review of right multiplication by transposition matrix</a>	04m, 07s	
10. <a href="#">The algebra of right multiplication by a dilation matrix</a>	11m, 44s	
11. <a href="#">The algebra of right multiplication by a shear matrix</a>	13m, 10s	
12. <a href="#">The algebra of left multiplication by an identity matrix</a>	05m, 52s	
13. <a href="#">The algebra of left multiplication by transposition matrix</a>	02m, 51s	
14. <a href="#">The algebra of left multiplication by a dilation matrix</a>	01m, 26s	
15. <a href="#">The algebra of left multiplication by a shear matrix</a>	12m, 40s	
16. <a href="#">More about the pedagogy of matrix multiplication</a>	07m, 32s	

## MATH 2B, Lesson 12

[The Nonsingular Linear Systems Problem](#)

(24 Videos: 2h, 07m, 44s)

Video Title	Length	Complete
1. <a href="#">Introduction to Nonsingular linear-systems problems</a>	06m, 12s	
2. <a href="#">Example 1 of nonsingular system modeling gravity</a>	05m, 57s	
3. <a href="#">Set up of nonsingular matrix to model gravity</a>	10m, 34s	
4. <a href="#">Set up of 5-by-5 backward substitution</a>	04m, 33s	
5. <a href="#">Step 0 of 5-by-5 backward substitution</a>	04m, 04s	
6. <a href="#">Step 1 of 5-by-5 backward substitution</a>	02m, 59s	
7. <a href="#">Step 2 of 5-by-5 backward substitution</a>	06m, 46s	
8. <a href="#">Final steps of 5-by-5 backward substitution</a>	04m, 05s	
9. <a href="#">General backward substitution algorithm</a>	05m, 26s	
10. <a href="#">Recall Nonsingular System Elimination for Gravity</a>	02m, 37s	
11. <a href="#">How to Use Shear Matrix to Introduce Zeros</a>	07m, 14s	
12. <a href="#">Transform 3-by-3 to Upper-Triangular with 1<sup>st</sup> Shear</a>	05m, 44s	
13. <a href="#">Transform 3-by-3 to Upper-Triangular with 2<sup>nd</sup> Shear</a>	09m, 20s	
14. <a href="#">Does it Matter What Pivot We Choose</a>	03m, 44s	
15. <a href="#">Transform 3-by-3 to Upper-Triangular with 3<sup>rd</sup> Shear</a>	05m, 58s	
16. <a href="#">Use Backward Substitution to Solve 3-by-3 system</a>	06m, 23s	
17. <a href="#">Solution to Gravity Modeling Problem</a>	03m, 44s	
18. <a href="#">Definition of a Regular Matrix</a>	02m, 10s	
19. <a href="#">Solving Nonsingular Systems via Elementary Matrices</a>	04m, 41s	
20. <a href="#">Are Elementary Matrices the Best We Have?</a>	04m, 06s	
21. <a href="#">Overview of Applied Linear Algebra So Far</a>	04m, 46s	
22. <a href="#">Intro to LU Factorization</a>	08m, 28s	
23. <a href="#">Forward substitution for 4-by-4 lower-triangular system</a>	03m, 01s	
24. <a href="#">General forward substitution algorithm</a>	05m, 12s	

## MATH 2B, Lesson 13

[Invertible Matrices](#)

(13 Videos: 1h, 10m, 31s)

Video Title	Length	Complete
1. <a href="#">Introduction to Invertible Matrices</a>	3m, 35s	
2. <a href="#">First Example of Singular Matrix</a>	3m, 56s	
3. <a href="#">Codomain and Range for Singular Matrix</a>	4m, 34s	
4. <a href="#">Nonsingular means linearly independent columns</a>	2m, 56s	
5. <a href="#">Definition of Invertible Matrices</a>	5m, 00s	
6. <a href="#">Not All Square Matrices Are Invertible</a>	4m, 48s	
7. <a href="#">More Examples of Invertible Matrices</a>	6m, 42s	
8. <a href="#">Invertible Diagonal Matrices</a>	2m, 55s	
9. <a href="#">First Hints of Invertible Matrix Theorem</a>	2m, 17s	
10. <a href="#">Example of Inverse of a Shear Matrix</a>	6m, 50s	
11. <a href="#">Proof that Shear Matrices are Invertible</a>	10m, 34s	
12. <a href="#">Proof that Dilation Matrices are Invertible</a>	11m, 25s	
13. <a href="#">Conjecture- transposition matrices are invertible</a>	4m, 59s	

## MATH 2B, Lesson 14

[The Invertible Matrix Theorem](#)

(5 Videos: 24m, 08s)

Video Title	Length	Complete
1. <a href="#">Introduction to the Invertible Matrix Theorem</a>	3m, 00s	
2. <a href="#">The Invertible Matrix Theorem, Part 1</a>	4m, 49s	
3. <a href="#">The Invertible Matrix Theorem, Part 2</a>	6m, 10s	
4. <a href="#">The Invertible Matrix Theorem, Part 3</a>	5m, 19s	
5. <a href="#">The Inverse of a Transpose</a>	4m, 50s	

## MATH 2B, Lesson 15

[LU Factorization without Pivoting](#)

(21 Videos: 1h, 44m, 43s)

Video Title	Length	Complete
1. <a href="#">Definition of LU Factorization</a>	06m, 14s	
2. <a href="#">LU Factorization Sparsity Structure</a>	02m, 35s	
3. <a href="#">Inverse of a matrix product lemma</a>	02m, 35s	
4. <a href="#">Review of Nonsingular Gravity Model</a>	06m, 09s	
5. <a href="#">Product of Pivot 1 Shears</a>	09m, 37s	
6. <a href="#">Shears from different pivots don't mix well</a>	04m, 03s	
7. <a href="#">Sequence of L Matrices in Gravity Example</a>	02m, 42s	
8. <a href="#">Review of Gauss Transforms</a>	04m, 16s	
9. <a href="#">Inverting Gauss Transforms</a>	06m, 04s	
10. <a href="#">Finding the L from LU</a>	06m, 48s	
11. <a href="#">How to Use LU to Solve</a>	03m, 00s	
12. <a href="#">Forward Substitution in LU Solver</a>	05m, 55s	
13. <a href="#">4-by-4 LU Factorization Set Up</a>	03m, 14s	
14. <a href="#">4-by-4 LU Factorization Pivot 1</a>	06m, 07s	
15. <a href="#">4-by-4 LU Factorization Pivot 2</a>	05m, 15s	
16. <a href="#">4-by-4 LU Factorization Pivot 3</a>	03m, 10s	
17. <a href="#">Proof of Inverse Gauss Transform</a>	09m, 20s	
18. <a href="#">Form 4-by-4 Lower Triangular L</a>	01m, 59s	
19. <a href="#">Gauss Transforms Have Layers</a>	05m, 46s	
20. <a href="#">The Finished 4-by-4 LU Factorization</a>	04m, 42s	
21. <a href="#">Using the 4-by-4 LU Factorization to Solve</a>	05m, 12s	

## Math 2B, Lesson 16

[Determinants](#)

(17 Videos: 1h, 31m, 06s)

Video Title	Length	Complete
1. <a href="#">Definition of Permutation</a>	05m, 36s	
2. <a href="#">Symmetric group on one and two elements</a>	06m, 02s	
3. <a href="#">Symmetric group on three elements</a>	08m, 49s	
4. <a href="#">Theorem: Transposition generate permutation</a>	03m, 58s	
5. <a href="#">Review of Nonsingular Systems</a>	04m, 45s	
6. <a href="#">Checking nonsingularity can be painful</a>	04m, 48s	
7. <a href="#">Dreaming of Determinants</a>	03m, 55s	
8. <a href="#">Deeper Dive into Nonsingularity</a>	07m, 18s	
9. <a href="#">First Guesses about Determinant Function</a>	02m, 15s	
10. <a href="#">Enter Area of Parallelogram</a>	04m, 33s	
11. <a href="#">Derivation of 2-by-2 Determinant via Geometry</a>	06m, 41s	
12. <a href="#">Definition of 2-by-2 Determinant via Geometry</a>	01m, 40s	
13. <a href="#">Conjectures for Elementary Matrix Determinants</a>	05m, 46s	
14. <a href="#">Permutation Definition of Determinants</a>	03m, 54s	
15. <a href="#">Intro to Permutations for 2-by-2 Determinants</a>	06m, 11s	
16. <a href="#">The sign of permutations in <math>S_2</math></a>	09m, 39s	
17. <a href="#">Use Permutations to define 2-by-2 Determinants</a>	05m, 16s	

## MATH 2B, Lesson 17

[The General Linear-Systems Problem](#)

(10 Videos: 1h, 53m, 12s)

Video Title	Length	Complete
1. <a href="#">The General Linear Systems Problem</a>	9m, 24s	
2. <a href="#">The Gaussian Elimination Approach to Solving General Linear Systems</a>	7m, 18s	
3. <a href="#">Definition of Row Echelon Form</a>	8m, 30s	
4. <a href="#">Definition of Reduced Row Echelon Form</a>	5m, 25s	
5. <a href="#">The Final Approach GLSP</a>	5m, 59s	
6. <a href="#">Set Up the Final Approach GLSP</a>	18m, 11s	
7. <a href="#">Solve the Final Approach GLSP</a>	13m, 42s	
8. <a href="#">Fourth Degree Model of a Potato Gun as a GLSP</a>	14m, 13s	
9. <a href="#">Playing with a Toy General Linear Systems Problem</a>	15m, 38s	
10. <a href="#">Playing with a second toy general linear-systems problem</a>	14m, 49s	

## MATH 2B, Lesson 18

[Solution Sets for the General Linear-Systems Problem](#)

(10 Videos: 2h, 25m, 43s)

Video Title	Length	Complete
1. <a href="#">The template for complete solutions to linear-systems problems</a>	10m, 55s	
2. <a href="#">Example 1 of the template for complete solutions to linear-systems problems</a>	21m, 42s	
3. <a href="#">Theorem: Elementary matrices preserve linear system solutions</a>	17m, 18s	
4. <a href="#">Example 2 with more on the template for complete solutions to linear systems</a>	24m, 19s	
5. <a href="#">Example 2, part 2: further exploring the unique, special trivial solutions</a>	13m, 11s	
6. <a href="#">Theorem: Complete solutions to homogeneous linear-systems problems</a>	15m, 25s	
7. <a href="#">Definitions of non)pivot positions, columns, and entries</a>	15m, 02s	
8. <a href="#">Definitions of pivot variables and free variables</a>	8m, 49s	
9. <a href="#">A general linear-systems problem from electric circuit analysis</a>	12m, 15s	
10. <a href="#">Notes about the rank of a matrix</a>	6m, 36s	

## MATH 2B, Lesson 27

[How to use eigenvalues to model the real world?](#)

12 Videos: 3h, 48m, 13s

Video Title	Length	Complete
1. <a href="#">Introduction to the Standard Eigenvalue Problem</a>	29m, 05s	
2. <a href="#">Introduction to the coupled pendula problem</a>	5m, 40s	
3. <a href="#">What is a McCusker apparatus?</a>	5m, 23s	
4. <a href="#">Visualizing the coupled pendula problem</a>	11m, 27s	
5. <a href="#">The formal statement of the coupled pendula problem</a>	8m, 21s	
6. <a href="#">Steps to Mathematize the Coupled Pendula Problem</a>	3m, 55s	
7. <a href="#">Study the motion of a single pendulum</a>	21m, 45s	
8. <a href="#">Derive the ordinary differential equation for a simple pendulum</a>	37m, 44s	
9. <a href="#">How to linearize the nonlinear ODE for a simple pendulum</a>	28m, 53s	
10. <a href="#">Mathematical model for the coupled pendula problem</a>	27m, 49s	
11. <a href="#">State the coupled pendula ODEs using matrices</a>	14m, 22s	
12. <a href="#">The standard eigenvalue problem to model coupled pendula</a>	33m, 40s	

## MATH 2B, Lesson 28

[Introduction to Eigenvalue Theory](#)

5 Videos: 1h, 28m, 59s

Video Title	Length	Complete
1. <a href="#">Solving the coupled pendula standard eigenvalue problem</a>	27m, 30s	
2. <a href="#">The Story of Eigenvalue Education, Part 1</a>	18m, 50s	
3. <a href="#">The Story of Eigenvalue Education, Part 2</a>	7m, 40s	
4. <a href="#">Case studies of eigenvalues of 2-by-2 matrices: Analyze, Categorize, Relate</a>	9m, 43s	
5. <a href="#">When is a 2-by-2 symmetric matrix positive definite?</a>	25m, 11	



Jeff Anderson's  
Applied Linear Algebra  
Advanced Applied Problems Playlists

## Math 2B: In-Class Lab Exercises

[Introduction to the Electronics Learning Laboratory Kit](#)

(12 Videos: 2 h, 5m, 3s)

Video Title	Length	Complete
1. <a href="#">Introduction to the Linear Algebraic Nodal Analysis Algorithm Learning Lab</a>	2m, 19s	
2. <a href="#">The Electronics Learning Lab Kit for Linear Algebraic Nodal Analysis</a>	6m, 14s	
3. <a href="#">What is a Solderless Breadboard?</a>	13m, 23s	
4. <a href="#">Introduction to Resistors</a>	13m, 56s	
5. <a href="#">Introduction to DC Voltage Sources</a>	10m, 5s	
6. <a href="#">Introduction to DC Current Sources</a>	6m, 6s	
7. <a href="#">Let's build our first circuit with a resistor and dc voltage source</a>	9m, 25s	
8. <a href="#">How do we measure the voltage drop across an element using a digital multimeter?</a>	12m, 7s	
9. <a href="#">Some intuition about the voltage drop across an element</a>	14m, 55s	
10. <a href="#">What the heck is measurement polarity?</a>	13m, 25s	
11. <a href="#">How do we measure current using a digital multimeter?</a>	7m, 55s	
12. <a href="#">Measuring circuit variables: Example 1</a>	15m, 33s	

## Math 2B: In-Class Lab Exercises

[Basic Concepts in Circuit Analysis, Part 1](#)

(6 Videos: 1h, 41m, 45s)

Video Title	Length	Complete
1. <a href="#">Measuring Circuit Variables: Example 3</a>	17m, 35s	
2. <a href="#">Measuring Circuit Variables: Example 5</a>	14m, 44s	
3. <a href="#">Parallel and Series Circuits</a>	11m, 11s	
4. <a href="#">The Canonical Circuit Element</a>	14m, 20s	
5. <a href="#">The Nodes of a Circuit</a>	14m, 13s	
6. <a href="#">Measuring Circuit Variables: Example 7</a>	29m, 42s	

## Math 2B: In-Class Lab Exercises

[Linear Algebraic Nodal Analysis: Example 2](#)

(20 Videos: 3h, 44m, 39s)

Video Title	Length	Complete
1. <a href="#">Linear Algebraic Nodal Analysis, Example 2: Circuit Model Verification</a>	14m, 31s	
2. <a href="#">LANA Example 2, Step 1: Identify and label the entire set of nodes in our circuit</a>	4m, 37s	
3. <a href="#">LANA Example 2, Step 2: Model the circuit as a directed graph</a>	13m, 08s	
4. <a href="#">LANA Example 2, Step 3: Create the entire incidence matrix</a>	7m, 43s	
5. <a href="#">LANA Example 2, Step 4: Create all circuit vectors</a>	10m, 43s	
6. <a href="#">LANA Example 2, Step 5A: State the entire set of KVLs in node potential form</a>	16m, 02s	
7. <a href="#">LANA Example 2, Step 5B: State the branch constitutive relations for the circuit</a>	6m, 04s	
8. <a href="#">LANA Example 2, Step 5C: State the entire set of Kirchhoff's current laws</a>	9m, 25s	
9. <a href="#">LANA Example 2, Step 6: Determine all ordinary and generalized nodes</a>	18m, 1s	
10. <a href="#">LANA Example 2, Step 6 Extension Part 1</a>	22m, 59s	
11. <a href="#">LANA Example 2, Step 6 Extension Part 2</a>	22m, 55s	
12. <a href="#">LANA Example 2, Step 7: Ground the circuit</a>	17m, 51s	
13. <a href="#">LANA Example 2, Step 8: State the grounded circuit equations</a>	20m, 29s	
14. <a href="#">LANA Example 2, Step 9: Identify (non)essential nodes and supernodes</a>	9m, 14s	
15. <a href="#">LANA Example 2, Step 10: Eliminate node dependencies from voltage sources</a>	17m, 48s	
16. <a href="#">LANA Example 2, Step 11: State the maximally deflated circuit equation</a>	13m, 02s	
17. <a href="#">LANA Example 2, Step 11 Extension Part 1</a>	20m, 02s	
18. <a href="#">LANA Example 2, Step 11 Extension Part 2</a>	32m, 31s	
19. <a href="#">LANA Example 2, Step 11 Extension Part 3</a>	14m, 57s	
20. <a href="#">LANA Example 2, Step 11 Extension Part 4</a>	23m, 54s	