

PETERS TOWNSHIP HIGH SCHOOL

COURSE SYLLABUS: LINEAR ALGEBRA HONORS

Course Overview and Essential Skills

This college level mathematics course will cover linear algebra and matrix theory emphasizing topics useful in other disciplines such as physics and engineering. This course is equivalent to a college linear algebra course.

Course Textbook and Required Materials

- *Elementary Linear Algebra*, Seventh Edition, Ron Larson, 2013, Brooks/Cole, Cengage Learning.
- Online textbook: www.cengage.com
- Required daily materials: Textbook, Three-Ring Binder, Pencil, Graphing Calculator (TI-83 Plus, TI-84, or TI-84 Plus)

Course Outline of Material Covered:

Unit or Topic	Concepts/Skills/Resources	Timeframe
Systems of Linear Equations	<ul style="list-style-type: none"> • Categorize a linear equation in n variables • Formulate a parametric representation of solution set • Assess a system of linear equations to determine if it is consistent or inconsistent • Apply concepts to use back-substitution and Gaussian elimination to solve a system of linear equations • Investigate the size of a matrix and write an augmented or coefficient matrix from a system of linear equations • Apply concepts to use matrices and Gauss-Jordan elimination to solve a system of linear equations • Solve a homogenous system of linear equations • Design setup and solve a system of equations to fit a polynomial function to a set of data points • Design, set up and solve a system of equations to represent a network • Resources: Chapter 1 Textbook 	5 weeks
Matrices	<ul style="list-style-type: none"> • Categorize matrices as equal • Construct a sum matrix • Construct a product matrix • Assess two matrices as compatible • Apply matrix multiplication to solve a linear system • Investigate a matrix to determine if it has an identity matrix • Apply the algebra of matrices to determine if it is an elementary matrix • Solve a matrix equation using matrix algebra • Design, set up and solve an input-out matrix and design • Set up and solve a matrix equation to find the line of best fit • Resources: Chapter 2 Textbook 	5 weeks
Determinants	<ul style="list-style-type: none"> • Identify if a matrix has a determinant • Find the determinant of a matrix • Use cofactors and minors to find the determinant of a matrix • Find the determinant of a triangular matrix • Use Cramer's rule to solve a system of linear equations • Create solutions using determinants to solve analytic 	5 weeks

	<p>geometry problems</p> <ul style="list-style-type: none"> • Create solutions using determinants to formulate equations for lines and planes • Create solutions using determinants to calculate areas and volumes • Resources: Chapter 3 Textbook 	
Vector Spaces	<ul style="list-style-type: none"> • Add and subtract vectors • Scale vectors • Use an ordered pair to represent a vector • Create a vector from a linear combination of other vectors • Prove the properties of the additive identity and additive inverse • Create a linear combination of vectors • Prove sets are vector spaces • Prove sets are a subset of a vector space • Find linear combinations of vectors • Prove sets are a span of a set • Analyze a set as linearly dependent or independent • Determine if a set is a standard or nonstandard • Find the dimension of a subspace • Find the rank of a matrix • Find the nullspace of a matrix • Find a coordinate matrix relative to a standard and nonstandard basis • Find a transition matrix • Find the Wronskian of a set of functions • Test a set of solutions for linear independence • Create a rotation of a conic section. • Resources: Chapter 4 Textbook 	6 weeks
Inner Product Spaces	<ul style="list-style-type: none"> • Calculate the length of a vector • Calculate the distance between two vectors • Calculate the dot product of two vectors • Calculate the angle between two vectors • Formulate an orthogonal projection of a vector • Analyze sets to determine if the set is orthogonal or orthonormal • Utilize the Gram-Schmidt process • Solve the least squares problem using orthonormalization • Find the cross product of two vectors. • Resources: Chapter 5 Textbook 	5 weeks
Linear Transformations	<ul style="list-style-type: none"> • Calculate the image of a vector space • Calculate the pre-image of a vector space • Verify linear transformations • Calculate the kernel of a vector space • Determine the nullity and rank of a vector space • Analyze a vector space to determine the standard matrix • Prove that a linear transformation is invertible • Prove that a square matrix is similar • Utilize elementary matrices in R^2 and R^3 to perform linear transformations. • Resources: Chapter 6 Textbook 	5 weeks
Eigenvalues and Eigenvectors	<ul style="list-style-type: none"> • Calculate eigenvalues and eigenvectors • Prove that a set is a subspace 	6 weeks

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| | <ul style="list-style-type: none">• Calculate the eigenvalues of a triangular matrix• Create a diagonalization from a square matrix• Prove that a square matrix is orthogonal and• Solve population growth problems using eigenvalues.• Resources: Chapter 7 Textbook | |
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****Depending on the needs of the class or changes in the school year, the course outline is subject to change.***