

# Imaging Science Math Crash Course

When: June 3rd (Mon) – August 2nd (Fri), 2024

Registration: April 12th - May 13th 2024

## This math crash course is...

- designed with first-year Imaging Science PhD courses in mind and open to everyone interested in learning math fundamentals in the context of imaging science research
- 5 weeks of Linear algebra and 4 weeks of Calculus
- hybrid (in-person meetups + zoom)
- low time commitments. We will provide self-guided problem sets and lecture-style problem sessions every week.



## Tutoring Sessions

- Weekly lessons and tutoring sessions will be available for each course!
- Virtual (zoom) sessions are available based on need

## Testimonials:

"The material itself was well-planned, and allowed me to test my understanding with plenty of resources to get help if needed."

"[I] found the last course, Signals & Systems, really helpful because I do not have an engineering background."

"I loved and appreciated the course so much!"

Visit our website for more information !

Questions?  
Send us an email at:  
imsci.wustl.mathbc@gmail.com



## Linear Algebra: Beginner

- Systems of Linear Equations and Vector Equations
- Row Reduction and Echelon Forms
- The Matrix Equation  $Ax = b$  and Solution Sets of Linear Systems
- Linear Independence
- Introduction to Linear Transformations
- The Matrix of a Linear Transformation
- Matrix Operations and Inverse of a Matrix
- Vector Spaces and Subspaces
- Null Spaces, Column Spaces, and Linear Transformations
- Linearly Independent Sets; Bases
- Eigenvectors and Eigenvalues

## Linear Algebra: Advanced

Beginner Linear Algebra Modules, plus:

- Diagonalization
- Eigenvectors and Linear Transformations
- Diagonalization of Symmetric Matrices
- The Singular Value Decomposition
- Principal Component Analysis
- Orthogonal Projections and Inner Product Spaces
- Subspaces and Hyperplanes
- Linear Separability and Support Vector Machines

## Calculus: Beginner

- Limits Continuity, and Derivative of a Function
- Derivative Rules: Power, Sine/Cosine, Product/Quotient, Chain, and Inverse
- Partial Derivatives and Tangent Planes
- Gradients and Chain Rule
- Integral and Antiderivatives
- Properties of Definite, Double, and Triple Integrals
- Trigonometric Integrals and Trigonometric Substitutions
- Improper Integrals and Probability Densities
- Integration by Parts and Expectation Values

## Calculus: Advanced

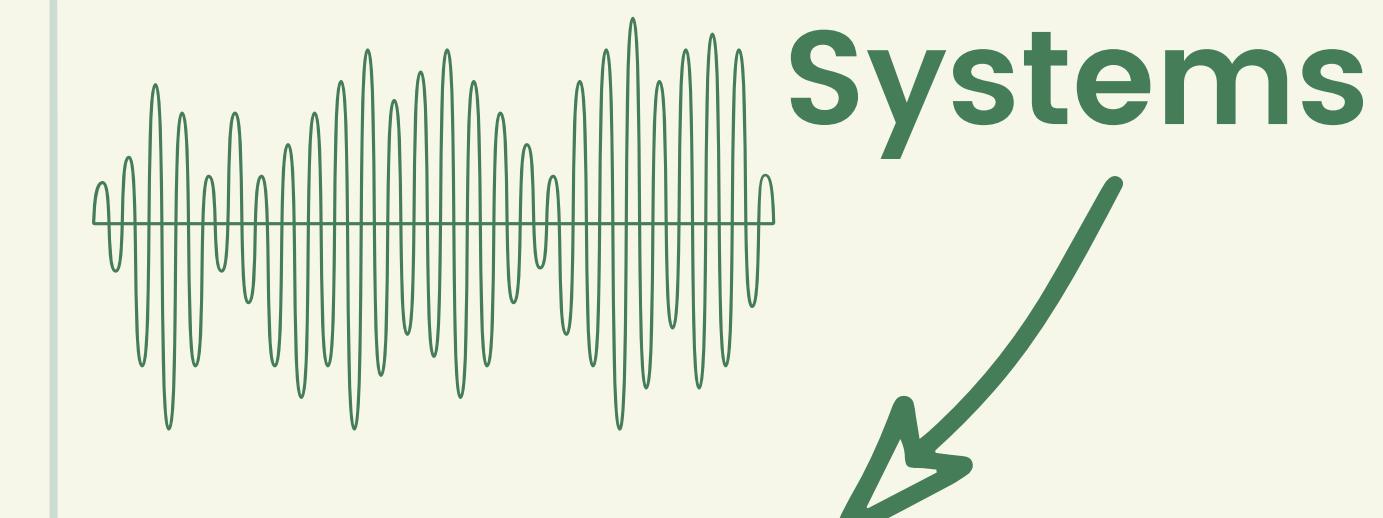
- Derivative Rules: Power, Sine/Cosine, Product/Quotient, MVT, L'Hopital Rule, Chain and Inverse, Extrema and Concavity
- Integrals, Antiderivatives, Definite, Double, and Triple Integral
- Improper Integral and Probability Densities
- Integration by Parts, Expectation Values, and Higher Moments of Distribution
- Introduction to Delta Functions and Complex Exponentials
- Convolution
- Point Spread Function
- Fourier Transform of Periodic Signals
- Properties of Fourier Transform

## Applications in...

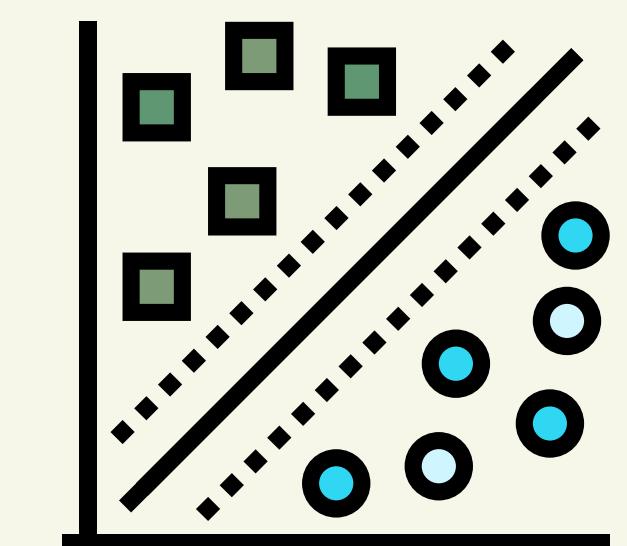
Probability



Signals and Systems



Machine Learning



## Choose your own time commitment!

- 5 Hours/Week
- 10 Hours/Week
- 15 Hours/Week

Once you register, schedule a 1:1 meeting with tutors & organizers to decide which track works best for you!

## Student Talks

Hear from current graduate students and postdoctoral researchers about how linear algebra and calculus are used in their research!

## Community Engagement

Meet fellow researchers from across the Danforth and Medical campuses!