

# Potential Modules for p5.math.js

## Linear Algebra and Matrices

### Simple matrix operations

- Implementing iterable matrices of size  $n \times m$  (utilizing existing p5.Matrix, or completely new implementation using vectors)
- Matrix addition
- Matrix multiplication

### Slightly more complicated matrix operations

- Calculating reduced row echelon form
- Matrix inverter
- Linear system solver
- Matrix determinant calculator
- Matrix norm calculator

### Most computationally intense matrix operations

- Performing Gram-Schmidt orthogonalization on a matrix
- Finding eigenvalues and eigenvectors of a matrix
- Finding rank of a matrix

## Complex Numbers

### Basic complex numbers

- Unit vectors **i** and **j**
- Implementing complex numbers  $a + bi$  as vectors (a, b)
- Addition, multiplication, and conjugate of complex numbers
- Modulus (magnitude) of complex numbers
- Computing phase angles of complex numbers

### More complex complex numbers

- Calculating exponents  $a^z$  where  $z$  is complex (Euler's formula)
- Calculating exponents  $z^n$  where  $z$  is complex (de Moivre's formula)
- Eventually, this class can be used to express solutions to equations with complex roots

### Fun additions for visual learning

- Showing relationship between complex numbers and the real plane visually
- Visualization of the Mandelbrot set, demonstrating complex exponentiation
- Plots of the Riemann zeta function

## Calculus (both single and multiple variable)

### Simple calculus operations

- Limits
- Derived functions and derivatives at specified points
- Indefinite and definite integrals

### Slightly more complicated calculus operations

- Calculating continuity intervals for a given function
- Gradient, curl, divergence, and Laplacian
- Hessian and Jacobian matrices

## **Most computationally intense calculus operations**

- Series divergence/convergence calculator
- Riemann sum calculator
- Finding n'th order Maclaurin polynomials for given functions
- Finding n'th order Taylor polynomials for given functions about a point

## **Algebra**

### **Basic algebra**

- Solving linear equations
- Adding polynomials

### **More advanced algebra**

- Quadratic equation solver
- n'th order polynomial solver
- Finding asymptotes of given functions

### **Most intense algebra/visual algebra**

- Graphing equations
- Multiplying polynomials (Karatsuba's algorithm)

## **Geometry**

### **Basic geometry**

- Determining whether points are collinear/coplanar

### **More advanced geometry**

- App where students can walk through common theorems and proofs

### **Visualization of geometry**

- Interactive app explaining  $\pi$  and angles
- Interactive app where students can draw shapes and objects

## **Trigonometry**

### **Basic trig**

- Implementing all trig functions and inverses
- Support for both degrees and radians

### **More advanced trig**

- Checking if two trig functions are identical; simplifying trig identities

### **Visualization of trig**

- Interactive app explaining trig functions in relation to a triangle and to the unit circle