MB3 Advanced Learning Objectives

<u>Week 1</u>
- Students should be able to figure out the formula for the number of combinations or arrangements for a particular group of items being selected
- Students should be able to find out a certain amount of an item based on its rate of selection or creation
- Students will be able to solve problems with Pythagorean triples

<u>Week 2</u>
- Students should be able to figure out all arrangements for a type of number appearing within a set of numbers
- Students should be know how to use patterns within events occurring to find out probabilities of those events occurring at any time
- Students should know how to use proportions to find probabilities of a particular event occurring

<u>Week 3</u>
- Students should be able to calculate probabilities of events occurring based on all possibilities

<u>Week 4</u>
- Students should be able to calculate side lengths with the Pythagorean Theorem
- Students should be able to find areas of inscribed or circumscribed shapes
- Students should be able to use the distance formula
- Students should be able to maximize and minimize areas of shapes based on constraints
- Students should be able to make ratios using congruent shapes, and use those ratios to find other external parameters

<u>Week 6</u>
- Students should be able to completely factor a number into primes
- Students should be able to use any surface area and volume formula for a 3D shape for ratios and finding dimensions of any internal shape
- Students should be able to use the volume of a shape to find its surface area and vice versa

<u>Week 7</u>
- Students should be able to make ratios for angles and sides of triangles using the Pythagorean Theorem

- Students should be able to use ratios to find probabilities and total combinations for an event based on information given
- Students should be able to use ratios to create and solve systems of equations
- Students should be able to use geometric formulas for shapes to find probabilities of a point falling in those areas within a coordinate plane

Week 8
- Students should be able to figure out terms in a series based on formulas
- Students should be able to figure out terms in a series based on type of sequence
- Students should be able to factor polynomials and use this to solve for their variables
- Students should be able to use modular arithmetic
- Students should be able to convert between bases
- Students should be able to use patterns of a number's digits when raised to different powers to solve equations

Week 10
- Students should be able to use formulas for both geometric and arithmetic series to find any term in the series
- Students should be able to use definitions for both geometric and arithmetic series to find any term in the series, when given certain terms in the series
- Students should be able to find and use arithmetic and geometric sums of formulas
- Students should be able to recognize patterns and determine the type of series for a pattern, and use this to solve for other variables or terms

Week 11
- Students should know quadratic and cubic formulas to use them to find the solutions to equations
- Students should know how to substitute certain terms in equations to solve them (i.e. $y = 4x^4 + 2x^2 - 6, substitute\ n\ = 2x^2 -> \ y\ = n^2 + n - 6$
- Students should know how to solve systems of equations
- Students should know how to use equations, graph them, and use constraints to solve for the intercept and slope of any unknown equation

Week 12

- Students should be able to figure out all arrangements for a particular event based on given information
- Students should be able to calculate fractions for probabilities based on a series of possibilities and groups of events occurring

Week 13

- Students should know how to graph shapes on a coordinate plane
- Students should know how to use various graph equations to solve for particular arrangements of points on the graph, or for x and y
- Students should be able to use equations on a graph and other information given for a point to deduce where it is on a graph
- Students should be able to use geometric formulas for shapes to find their locations or their dimensions on a graph

Week 14

- Students should be able to use multiple subjects to solve any Sprint problem in MathCounts based on the subject