Chapter 1 - Functions & Graphs

- Interpret key features of graphs and tables in terms of quantities, and sketch graphs showing key features given a verbal description of the relationship.
- Graph functions expressed symbolically and show key features, by hand in simple cases and using technology for more complicated cases.
- Combine and compose functions.
- Identify the effect on the graph of replacing $f(x)$ by $f(x)+k$, $kf(x)$, $f(kx)$, and $f(x+k)$ for specific values of k (both positive & negative); find the value of k given the graphs.
- Find inverse functions.

Chapter 2 - Polynomial & Rational Functions

- Extend polynomial identitites to the complex numbers.
- Know the Fundamental Theorem of Algebra; show that it is true for quadratics.
- Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number a, the remainder on division by $x - a$ is $p(a)$, so $p(a) = 0$ if and only if $(x - a)$ is a factor of $p(x)$.
- Rewrite simple rational expressions in different forms; write $a(x)/b(x)$ in the form $q(x) + r(x)/b(x)$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$, using inspection, long division, or, for more complicated examples, a computer algebra system.
- Solve rational and radical equations in one variable, and give examples how extraneous solutions may arise.
- Interpret key features of graphs and tables in terms of quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where function is increasing, decreasing, positive, or negative; relative extrema; symmetries; end behavior
- Graph functions expressed symbolically and show key features, by hand in simple cases and using technology for more complicated cases.
- Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
- Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.
- Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.
- Compute (using technology) and interpret the correlation coefficient of a linear fit.

Chapter 3 - Exponentials and Logarithms

- Graph functions expressed symbolically and show key features, by hand in simple cases and using technology for more complicated cases.
- Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
- Combine and compose functions.
- Identify the effect on the graph of replacing $f(x)$ by $f(x)+k$, $kf(x)$, $f(kx)$, and $f(x+k)$ for specific values of k (both positive & negative); find the value of k given the graphs.
- Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.
- For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.

Chapter 8 - Conic Sections & Binomial Theorem

- Know and apply the Binomial Theorem for the expansion of $(x + y)^n$ in powers of x and y for a positive integer n, where x and y are any numbers, with coefficients determined for example by Pascal's Triangle.
- Understand that rational expressions for a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a non-zero rational expression; add, subtract, multiply, and divide rational expressions.
- Derive the equation of a circle of given center and radius using the Pythagorean Theorem.
- Derive the equation of a parabola given a focus and directrix.
- Derive the equations of ellipses and hyperbolas given the foci, using the fact that the sum or difference of distances from the foci is constant.

Chapter 4 - Trigonometric Functions

- Understand radian measure of an angle as length of the arc on the unit circle subtended by the angle.
- Explain how the unit circle in the coordinate plane enables the extension of trig functions to all reals, interpreted as radian measures of angles traversed counterclockwise around the unit circle.
- Use special triangles to determine geometrically the values of sine, cosine, tangent for π/3, π/4 and π/6, and use the unit circle to express the values of sine, cosine, and tangent for x, π + x, and 2π - x in terms of their values for x, where x is any real number.
- Use the unit circle to explain symmetry (odd & even) & periodicity of trig functions.
- Choose trig functions to model periodic phenomena given amplitude, frequency, and midline.
- Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.
- Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context.
- Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

Chapter 5 - Analytic Trigonometry

- Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find sin(θ), cos(θ), or tan(θ) given sin(θ), cos(θ), or tan(θ) and the quadrant of the angle.
- Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems.
- Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.
- Derive the formula $A = 1/2\ ab \sin(C)$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.
- Prove the Laws of Sines and Cosines and use them to solve problems.
- Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).

Chapter 6 - Applications of Trigonometry

- Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
- Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers.

- Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number.
- Represent addition, subtraction, multiplication, and conjugation of complex numbers geometrically on the complex plane; use properties of this representation for computation.
- Calculate the distance between numbers in the complex plane as the modulus of the difference, and the midpoint of a segment as the average of the numbers at its endpoints.
- Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes
- Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point.
- Solve problems involving velocity and other quantities that can be represented by vectors.
- Add and subtract vectors.
- Multiply a vector by a scalar.

Chapter 7 - Matrices

- Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network.
- Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled.
- Add, subtract, and multiply matrices of appropriate dimensions.
- Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties.
- Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse.
- Work with 2 × 2 matrices as transformations of the plane, and interpret the absolute value of the determinant in terms of area.
- Represent a system of linear equations as a single matrix equation in a vector variable.
- Find the inverse of a matrix if it exists and use it to solve systems of linear equations

Chapter 9 - Discrete Mathematics

- Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems.
- Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations and translate between the two forms.
- Use permutations and combinations to compute probabilities of compound events and solve problems.