# CCSS Math Conceptual Categories and Clusters – Grades 9-12

## Number & Quantity

The Real Number System:
- Extend the properties of exponents to rational exponents.
- Use properties of rational and irrational numbers.

Quantities:
- Reason quantitatively, and use units to solve problems.

The Complex Number System:
- Perform arithmetic operations with complex numbers.
- Represent complex numbers and their operations on the complex plane.
- Use complex numbers in polynomial identities and equations.

Vector & Matrix Quantities:
- Represent and model with vector quantities
- Perform operations on vectors.
- Perform operations on matrices and use matrices in applications.

## Algebra

Seeing Structure in Expressions:
- Interpret the structure of expressions.
- Write expressions in equivalent forms to solve problems.

Arithmetic with Polynomials & Rational Expressions:
- Perform arithmetic operations on polynomials.
- Understand the relationship between zeros and factors of polynomials.
- Use polynomial identities to solve problems.
- Rewrite rational expressions.

Creating equations:
- Create equations that describe numbers or relationships.

Reasoning with Equations & Inequalities:
- Understand solving equations as a process of reasoning and explain the reasoning
- Solve equations and inequalities in one variable
- Solve systems of equations
- Represent and solve equations and inequalities graphically.

## Functions

Interpreting Functions:
- Understand the concept of a function and use function notation.
- Interpret functions that arise in applications in terms of the context.
- Analyze functions using different representations.

Building Functions:
- Build a function that models a relationship between two quantities.
- Build new functions from existing functions.

Linear, Quadratic, & Exponential Models:
- Construct and compare linear, quadratic, and exponential models and solve problems.
- Interpret expressions for functions in terms of the situation they model.

Trigonometric Functions:
- Extend the domain of trigonometric functions using the unit circle.
- Model periodic phenomena with trigonometric functions.
- Prove and apply trigonometric identities.

<---------- Modelling ---------->

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## Geometry

Congruence:
- Experiment with transformations in the plane.
- Understand congruence in terms of rigid motions.
- Prove geometric theorems.
- Make geometric constructions.

Similarity, Right Triangles, and Trigonometry:
- Understand similarity in terms of similarity transformations.
- Prove theorems involving similarity.
- Define trigonometric ratios and solve problems involving right triangles.
- Apply trigonometry to general triangles.

Circles:
- Understand & apply theorems about circles.
- Find arc lengths & areas of sectors of circles.

Expressing Geometric Properties with Equations:
- Translate between the geometric descriptions & the equation for a conic section.
- Use coordinates to prove simple geometric theorems algebraically.

Geometric Measurement & Dimension:
- Explain volume formulas and use them to solve problems
- Visualize relationships between two-dimensional and three-dimensional objects.

Modeling with Geometry:
- Apply geometric concepts in modeling situations.

## Statistics & Probability

Interpreting Categorical & Quantitative Data:
- Summarize, represent, and interpret data on both a single count of measurement variable and two categorical and quantitative variables.
- Interpret linear models.

Making Inferences and Justifying Conclusions:
- Understand and evaluate random processes underlying statistical experiments.
- Make inferences and justify conclusions from sample surveys, experiments, and observational studies.

Conditional Probability and the Rules of Probability:
- Understand independence and conditional probability and use them to interpret data.
- Use the rules of probability to compute probabilities of compound events in a uniform probability model.

Using Probability to Make Decisions:
- Calculate expected values and use them to solve problems.
- Use probability to evaluate outcomes of decisions.

<---------- M o d e l l n g ----------->

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