

CORE[®] Math Services Align with the Common Core State Standards Mathematics (High Schools)

CORE High School Math Academy Alignment with Common Core State Standards

CORE High School Math Academy emphasizes throughout each day the importance of teaching along the five proficiency strands identified by the National Research Council in *Adding It Up* (2001):

- Conceptual understanding
- Strategic competence
- Adaptive reasoning
- Productive disposition
- Procedural fluency

These correspond to the eight mathematical practices emphasized in the Common Core State Standards for all grade levels, as follows:

1. Make sense of problems and persevere in solving them. (*Procedural fluency*)
2. Reason abstractly and quantitatively. (*Adaptive reasoning*)
3. Construct viable arguments and critique the reasoning of others. (*Adaptive reasoning*)
4. Model with mathematics. (*Conceptual understanding and strategic competence*)
5. Use appropriate tools strategically. (*Strategic competence*)
6. Attend to precision. (*Procedural fluency*)
7. Look for and make use of structure. (*Conceptual understanding and strategic competence*)
8. Look for and express regularity in repeated reasoning. (*Conceptual understanding, strategic competence, and procedural fluency*)

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Common Core Strand	Focus Area	Standards	Corresponding CORE Service
Number and Operations: Fractions	Develop understanding of fractions, fraction equivalence, and operations with fractions	<p>This session serves as an intervention for struggling high school learners focusing on understanding and computing with fractions.</p> <ul style="list-style-type: none"> ● Understand a fraction $1/b$ as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction a/b as the quantity formed by a parts of size $1/b$. ● Understand a fraction as a number on the number line. Represent fractions on a number line diagram. ● Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size. ● Compare two fractions with different numerators and different denominators. ● Add and subtract fractions with unlike denominators. ● Solve word problems involving addition and subtraction of fractions referring to the same whole. Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers. ● Extend understanding of fraction equivalence and ordering. ● Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers. ● Use equivalent fractions as a strategy to add and subtract fractions. ● Interpret a fraction as division of the numerator by the denominator. ● Apply and extend previous understandings of multiplication to multiply fractions. ● Interpret multiplication as scaling. ● Solve real-world problems involving multiplication of fractions and mixed numbers. ● Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions. 	CORE Math Academy for High Schools, Sessions 1 Rational Numbers and Fractions

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The Number System	<p>Apply and extend previous understandings of multiplication and division to divide fractions by fractions</p> <p>Apply and extend previous understandings of numbers to the system of rational numbers</p>	<p>This session serves as an intervention for struggling high school learners focusing on understanding and computing with rational numbers.</p> <ul style="list-style-type: none"> • Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions. • Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers. Represent addition and subtraction on a horizontal or vertical number line diagram. • Describe situations in which opposite quantities combine to make 0. • Understand subtraction of rational numbers as adding the additive inverse, $p - q = p + (-q)$. • Apply properties of operations as strategies to add and subtract rational numbers. • Understand that positive and negative numbers are used together to describe quantities having opposite directions or values, and use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation. • Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates. • Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line. Recognize that the opposite of the opposite of a number is the number itself (e.g., $-(-3) = 3$), and that 0 is its own opposite. 	<p>CORE Math Academy for High Schools, Session 1</p> <p>Rational Numbers and Fractions</p>


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The Complex Number System	Perform arithmetic operations with complex numbers	<ul style="list-style-type: none"> ● Know there is a complex number i such that $i^2 = -1$, and every complex number has the form $a + bi$ with a and b real. 	CORE Math Academy for High Schools, Session 1 Rational Numbers and Fractions
Ratios and Proportional Relationships	Understand ratio concepts and use ratio reasoning to solve problems	<p>This session serves as an intervention for struggling high school learners focusing on understanding and computing with ratio and proportions.</p> <ul style="list-style-type: none"> ● Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. ● Use ratio and rate reasoning to solve real-world and mathematical problems (e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations). <ul style="list-style-type: none"> ○ Make tables of equivalent ratios relating quantities with whole number measurements. Find missing values in the tables. ○ Find a percent of a quantity as a rate per 100. Solve problems involving finding the whole, given a part and the percent. ● Compute unit rates associated with ratios of fractions, including ratios of lengths, areas, and other quantities measured in like/different units. ● Recognize and represent proportional relationships between quantities. <ul style="list-style-type: none"> ○ Decide whether two quantities are in a proportional relationship. ○ Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships. ○ Represent proportional relationships by equations. ○ Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points $(0, 0)$ and $(1, r)$ where r is the unit rate. ● Use proportional relationships to solve multistep ratio and percent problems. 	CORE Math Academy for High Schools, Session 2 Ratio, Proportion, and Percent

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Expressions and Equations	Understand, write, reason about, and solve one- and two-variable equations and inequalities, and apply these to real-world situations	<p>This session serves as an intervention for struggling high school learners focusing on understanding and fluency with solving equations.</p> <ul style="list-style-type: none"> • Write, read, and evaluate expressions in which letters stand for numbers. • Apply the properties of operations to generate equivalent expressions. • Use variables to represent numbers and write expressions when solving a real-world or mathematical problem. Understand that a variable can represent an unknown number. • Solve linear equations in one variable. • Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients. • Solve multistep real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. • Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. • Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. 	<p>CORE Math Academy for High Schools, Session 3</p> <p>Algebra and Solving Equations</p>

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Quantities	Reason quantitatively and use units to solve problems	<ul style="list-style-type: none"> Use units as a way to understand problems and to guide the solution of multistep problems. Choose and interpret units consistently in formulas, and choose and interpret the scale and the origin in graphs and data displays. 	CORE Math Academy for High Schools, Session 3 Algebra and Solving Equations
	Seeing Structure in Expressions	<ul style="list-style-type: none"> Interpret expressions that represent a quantity in terms of its context. 	
	Seeing Structure in Expressions Creating Equations	<ul style="list-style-type: none"> Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. 	
	Create equations that describe numbers or relationships	<ul style="list-style-type: none"> Create equations and inequalities in one variable and use them to solve problems. Create equations in two or more variables to represent relationships between quantities. Graph equations on coordinate axes with labels and scales. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. 	

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Reasoning with Equations and Inequalities	Understand solving equations as a process of reasoning and explain the reasoning	<ul style="list-style-type: none"> Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method. 	CORE Math Academy for High Schools, Session 3 Algebra and Solving Equations
	Solve equations and inequalities in one variable	<ul style="list-style-type: none"> Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. Solve quadratic equations in one variable. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, using the quadratic formula, and factoring, as appropriate, to the initial form of the equation. 	CORE Math Academy for High Schools, Session 4 Algebra and Functions
	Represent and solve equations and inequalities graphically	<ul style="list-style-type: none"> Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line). Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$. Find the solutions approximately (e.g., using technology to graph the functions, make tables of values, or find successive approximations). Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. 	


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Interpreting Functions	Understand the concept of a function and use function notation	<ul style="list-style-type: none"> • Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x. The graph of f is the graph of the equation $y = f(x)$. • Use function notation, evaluate functions for inputs in their domains, and interpret statements using function notation in terms of a context. 	CORE Math Academy for High Schools, Session 4 Algebra and Functions
	Interpret functions that arise in applications in terms of the context	<ul style="list-style-type: none"> • For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. • Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. • Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. 	
Interpreting Functions (cont.)	Analyze functions using different representation	<ul style="list-style-type: none"> • Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. <ul style="list-style-type: none"> ○ Graph linear and quadratic functions and show intercepts, maxima, and minima. ○ Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. • Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. <ul style="list-style-type: none"> ○ "Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context ○ Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). 	CORE Math Academy for High Schools, Session 4 Algebra and Functions


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Linear and Exponential Models	Construct and compare linear and exponential models and solve problems	<ul style="list-style-type: none"> • Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. • Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. • Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). 	<p>CORE Math Academy for High Schools, Session 4</p> <p>Algebra and Functions</p>
	Interpret expressions for functions in terms of the situation they model	<ul style="list-style-type: none"> • Interpret the parameters in a linear or exponential function in terms of a context. 	
Geometry	Basic understandings of area, volume, congruence, similarity, and transformation	<p>This session serves as an intervention for struggling high school learners focusing on understanding of geometric shapes and the basics of area, volume, congruence, similarity, and transformations.</p> <ul style="list-style-type: none"> • Solve real-world and mathematical problems involving area, volume, and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms. • Verify experimentally the properties of rotations, reflections, and translations. Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations. 	<p>CORE Math Academy for High Schools, Session 5</p> <p>Geometry</p>

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Congruence	Prove geometric theorems	<ul style="list-style-type: none"> • Prove theorems about lines and angles. • Prove theorems about triangles. • Prove theorems about parallelograms. 	CORE Math Academy for High Schools, Session 5 Geometry
	Experiment with transformation in the plane	<ul style="list-style-type: none"> • Represent transformations in the plane using, e.g., transparencies and geometry software. Describe transformations as functions that take points in the plane as inputs and give other points as outputs. • Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch). • Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments. • Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another. • Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent. 	
Geometric Measurement and Dimension	Explain volume formulas and use them to solve problems	<ul style="list-style-type: none"> • Give an informal argument for the formulas for the circumference of a circle, area of a circle, and volume of a cylinder, pyramid, and cone. • Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. 	