Big Ideas in Mathematics

The Mathematics Big Ideas are important mathematical topics that provide focus of the mathematics experience for all students at each grade level. They are related ideas, concepts, skills and procedures that form the foundation of understanding, permanent learning and success at higher mathematics. They are indispensable elements in developing problem solving, reasoning, and critical thinking skills, which are important to all mathematics learning. (Adapted from the NCTM Curriculum Focal Points, 2006)

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The Big Ideas in Kindergarten

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Kindergarten Mathematics Big Ideas	Connections to the Big Ideas
Numbers and Operations: Represent numbers as whole numbers and fractions as part to whole, counting. Compare and order numerals. Join or separate items to form sets of numbers or objects.	**Numbers and Operations:** Use comparison and order to indicate one-to-one correspondence; use addition and subtraction as ways to represent joining and separating sets of numbers and objects. **Measurement:** Explore topics of time and money. **Algebraic Concepts:** Recognize and extend patterns of numbers or characteristics. **Data Analysis:** Interpret and create bar graphs to represent sets of numbers or measurements.
Measurement: Compare objects for length or weight directly or by comparing the objects to a third object. Order a set of objects by a specified characteristic.	
Geometry: Identify 2 dimensional and 3 dimensional shapes in different sizes and orientations. Use spatial sense to split complex objects into simpler ones or to combine simple shapes to create complex objects. Recognize lines of symmetry.	

The Big Ideas in Grade 1

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Grade 1 Mathematics Big Ideas	Connections to the Big Ideas
Numbers and Operations: Develop an understanding of whole number relationships, including grouping in tens and ones. Develop strategies for adding and subtracting whole numbers. Use a variety of models, including discrete objects, length-based models (e.g., lengths of connecting cubes), and number lines, to model "part-whole," "adding to," "taking away from," and "comparing" situations to understand the meanings of addition and subtraction and strategies to solve such arithmetic problems.	**Measurement:** Describe objects using attributes using length, width, and volume. Understand and solve problems involving measurement including time, temperature, and money. Use standard and nonstandard units to measure length. **Data Analysis:** Answer questions about and represent measurements and data in picture and bar graphs involving counting and comparisons.
Geometry: Compose and decompose 2-dimensional and 3-dimensional geometric shapes. Describe their geometric attributes and properties to determine how they are alike and different.	
Algebraic Concepts: Understand the connections between counting and the operations of addition and subtraction (e.g., adding two is the same as "counting on" two). Use properties of addition (commutativity and associativity) to add whole numbers. Solve addition and subtraction problems involving basic facts. Relate addition and subtraction as inverse operations. Identify and extend patterns of numbers and objects.	

The Big Ideas in Grade 2

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Grade 2 Mathematics Big Ideas	Connections to the Big Ideas
Numbers and Operations: Develop an understanding of the base-ten numeration system including place-value concepts and expanded notation. Develop quick recall of addition facts and related subtraction facts and fluency with multi-digit addition and subtraction.	*Measurement:* Explore money and time. *Data Analysis:* Answer questions about and represent measurements/data in picture and bar graphs involving counting and comparisons.
Measurement: Develop an understanding of linear measurement and facility in measuring lengths in standard and nonstandard units. Estimate, measure, and compute lengths as they solve problems involving data, space, and movement through space.	
Geometry: Compose and decompose two-dimensional shapes (intentionally substituting arrangements of smaller shapes for larger shapes or substituting larger shapes for many smaller shapes),	
Algebraic Concepts: Recognize and extend patterns. Create an equation to match a problem situation. Determine the missing number or symbol in a number sentence.	

The Big Ideas in Grade 3

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Grade 3 Mathematics Big Ideas	Connections to the Big Ideas
Numbers and Operations: Develop understandings of multiplication and division and strategies for basic multiplication facts and related division facts. Understand the meanings of multiplication and division of whole numbers through the use of representations (e.g., equal-sized groups, arrays, area models, and equal "jumps" on number lines for multiplication, and successive subtraction, partitioning, and sharing for division). Develop an understanding of the meanings and uses of fractions to represent parts of a whole, parts of a set, or points/distances on a number line. Understand that the size of a fractional part is relative to the size of the whole, and that fractions are used to represent numbers that are equal to, less than, or greater than 1.	**Numbers and Operations:** Extend understanding of place value to numbers up to 10,000 in various contexts. Use estimation skills to arrive at conclusions. **Measurement:** Continue to develop understandings and applications of money and time. **Data Analysis:** Construct and analyze frequency tables, bar graphs, picture graphs, and line plots and use them to solve problems.
Measurement: Solve problems in linear measurement that call for more precision than the whole unit. Understand perimeter as a measurable attribute and select appropriate units, strategies, and tools to solve problems involving perimeter.	
Geometry: Describe, analyze, compare, and classify 2-dimensional shapes by the number of sides and angles and 3-dimensional shapes by faces, corners, and edges. Investigate, describe, and reason when decomposing, combining, and transforming polygons to make other polygons. Understand and apply the concepts of congruence and symmetry.	
Algebraic Concepts: Use properties of addition and multiplication (e.g., commutativity, associativity, and distributive property) to multiply whole numbers and apply increasingly sophisticated strategies based on these properties to solve multiplication and division problems that go beyond basic facts.	

The Big Ideas in Grade 4

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Grade 4 Mathematics Big Ideas	Connections to the Big Ideas
Numbers and Operations: Develop quick recall of basic multiplication facts and related division facts. Develop fluency with efficient procedures, including the standard algorithm, for multiplying whole numbers and use them to solve problems. Understand decimal notation as an extension of the base-ten system of writing whole numbers. Connect equivalent fractions and decimals.	*Data Analysis:* Use the concept of place value to develop an understanding of and use stem-and-leaf plots. *Algebraic Concepts:* Understand the use of a function rule to describe a sequence of numbers or objects.
Measurement: Develop an understanding of area and introduce the areas of 2-dimensional shapes.	*Geometry:* Understand properties of 2-dimensional shapes to find the area of polygons. Expand symmetry and congruence to include basic transformations, reflection and rotation. Use transformations to design and analyze simple tilings and tessellations.

The Big Ideas in Grade 5

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Grade 5 Mathematics Big Ideas	Connections to the Big Ideas
Numbers and Operations: Develop an understanding of and fluency with division of whole numbers. Develop an understanding of and fluency with addition and subtraction of fractions and decimals.	**Data Analysis:** Construct and analyze double-bar and line graphs and use ordered pairs on coordinate grids.
Measurement: Estimate and calculate volume and surface area for various 3- dimensional shapes.	
Geometry: Describe 3-dimensional shapes and analyze their properties. Decompose 3-dimensional shapes into 2-dimensional components.	
Algebraic Concepts: Use patterns, models, and relationships as contexts for writing and solving simple equations and inequalities. Create graphs of simple equations. Explore prime and composite numbers and discover concepts related to the addition and subtraction of fractions as they use factors and multiples, include applications of common factors and common multiples.	

The Big Ideas in Grade 6

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Grade 6 Mathematics Big Ideas	Connections to the Big Ideas
Numbers and Operations: Develop an understanding of and fluency with multiplication and division of fractions and decimals. Multiply and divide fractions and decimals to solve problems, including multi-step problems and problems involving measurement. Connect ratio and rate to multiplication and division.	*Data Analysis:* Understand and calculate measures of central tendency of data sets including mean, median, and mode. Calculate the probability of simple events.
Algebraic Concepts: Write mathematical expressions and equations that correspond to given situations, evaluate expressions, and use expressions and formulas to solve problems. Use variables appropriately.	*Measurement and Geometry:* Solve problems that involve area and volume; find areas or volumes from lengths and find lengths from volumes or areas.

The Big Ideas in Grade 7

The Mathematics Big Ideas are essential mathematical topics that provide focus of the mathematics experience for all students at each grade level. They are related ideas, concepts, skills and procedures that form the foundation of understanding, permanent learning and success at higher mathematics. They are indispensable elements in developing problem solving, reasoning, and critical thinking skills, which are important to all mathematics learning. (Adapted from the NCTM Curriculum Focal Points, 2006)

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Grade 7 Mathematics Big Ideas	Connections to the Big Ideas
Numbers and Operations: Understand proportionality and use it to solve single and multi-step problems including problems involving percent, percent increase and percent decrease. ***Measurement and Geometry:*** Solve problems about similar objects (including figures) by using scale factors that relate corresponding lengths of the objects or by using the fact that relationships of lengths within an object are preserved in similar objects. ***Algebraic Concepts:*** Graph proportional relationships and identify the unit rate as the slope of the related line.	***Data Analysis and Probability:*** Use proportions to make estimates relating to a population on the basis of a sample. Apply percentages to make and interpret histograms and circle graphs. Understand that when all outcomes of an experiment are equally likely, the theoretical probability of an event is the fraction of outcomes in which the event occurs. Use theoretical probability and proportions to make approximate predictions.

The Big Ideas in Pre-Algebra

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Pre-Algebra Big Ideas	Connections to the Big Ideas
Measurement and Geometry: Use fundamental facts about distance and angles to describe and analyze figures and situations in 2- dimensional and 3-dimensional space and to solve problems, including those with multiple steps. Understand and apply the Pythagorean theorem to find distances between points in the coordinate plane and to analyze polygons and polyhedra.	*Numbers and Operations:* Use exponents and scientific notation to describe very large and very small numbers. Use square roots when they apply the Pythagorean theorem. *Data Analysis and Probability:* Use box-and-whisker plots to convey information about the spread of data. Use scatterplots to display bivariate data, and informally estimate lines of best fit to make and test conjectures. Use probability to make predictions and inferences.
Algebraic Concepts: Use linear functions, linear equations, and systems of linear equations to represent, analyze, and solve a variety of problems. Translate among verbal, tabular, graphical, and algebraic representations of functions and describe how such aspects of a function as slope and *y*-intercept appear in different representations.	
Data Analysis: Use descriptive statistics, including mean, median, and range, to summarize and compare data sets, and organize and display data to pose and answer questions. Select the mean or the median as the appropriate measure of center for a given purpose.	

The Big Ideas in Algebra I

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Algebra 1 Big Ideas	Connections to the Big Ideas
Numbers and Operations: Represent and use numbers in equivalent forms to describe real life situations and solve problems arising from those situations; use estimation and proportional reasoning to solve problems.	***Geometry:*** Solve problems and explore relationships using analytic geometry and linear equation techniques. ***Algebraic Concepts and Data Analysis and Probability:*** Calculate and interpret the slope and y-intercept of a linear relationship to answer questions about a real world situation.
Algebraic Concepts: Use algebraic expressions to model real world phenomena. Write, solve and/or graph linear equations and/or linear inequalities to model relationships between quantities. Use and interpret quadratic, and/or exponential functions to model real world situations.	
Data Analysis and Probability: Represent quantitative and qualitative data in numerical summaries and graphical displays; answer questions that can be answered with data; interpret graphs of one-variable and two-variable situations; make predictions based on analysis and displays of data and basic concepts of probability.	

The Big Ideas in Algebra 2

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Algebra 2 Big Ideas	Connections to the Big Ideas
Algebraic Concepts: Use polynomial, exponential and logarithmic functions to model real world phenomena and solve problems arising from those situations. Write, solve and/or graph linear, polynomial, exponential and logarithmic equations and/or inequalities to model relationships between quantities.	**Numbers and Operations and Data Analysis:** Apply counting techniques in problem solving settings. **Measurement:** Use trigonometric ratios to perform indirect measurements. **Algebraic Concepts and Geometry:** Extend properties and concepts of right triangles to include trigonometric ratio and functions. **Algebraic Concepts:** Understand matrices and matrix operations. Solve systems of linear equations using matrix techniques.
Data Analysis and Probability: Use measures of central tendency and dispersion to describe sets of data. Use a variety of functions to model bivariate data from tables or scatterplots. Solve problems dealing with chance and random events using concepts of probability or making predictions from data.	

The Big Ideas in Geometry

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Geometry Big Ideas	Connections to the Big Ideas
Measurement: Develop or apply procedures to calculate measures of angles, area and perimeter for 2-dimensional figures and measures of volume and surface area for 3-dimensional figures. Describe and verify how a change on one measurement in a two or three dimensional figure will affect other measurements of that figure.	**Numbers and Operations:** Use rational and irrational numbers in quantifying geometric properties and in solving problems involving 2 and 3- dimensional shapes. **Data Analysis and Probability:** Use concepts of area to answer probability questions. **Algebraic Concepts:** Solve problems using concepts of slope and distance in analytic geometry.
Geometry: Use concepts of congruence and similarity to relate and compare 2 and 3- dimensional figures. Use geometric properties to verify and/or establish relationships involving 2 and 3- dimensional figures. Solve problems using proportional reasoning and the Pythagorean Theorem.	

The Big Ideas in Pre Calculus

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Pre Calculus Big Ideas	Connections to the Big Ideas
Algebraic Concepts: Understand and apply concepts, graphs, and applications of a variety of families of functions, including polynomial, exponential, logarithmic, logistic and trigonometric. Use appropriate functions to model real world situations and solve problems that arise from those situations.	**Numbers and Operations:** Understand the nature and subsets of the real number system. **Data Analysis and Probability:** Understand and use elementary probability functions and distributions to solve problems. **Measurement:** Use Laws of Sines and Cosines to solve problems dealing with the length of sides and measures of angles in triangles.
Data Analysis and Probability: Use a variety of techniques to "linearize data" by applying transformations to data to make linear regression more precise. Understand and use elementary probability functions and distributions to solve problems	