

# MATH

## Kindergarten

The Day School mathematics program strives to develop the basic concepts and skills that are used by students in their daily lives. The curriculum, aligned to NCTM (National Council of Teachers of Mathematics) standards, requires students to refine problem-solving skills through accurate conceptual and procedural knowledge and their practical applications. Mathematical reasoning is expanded through oral and written discussion to problems across the disciplines, but is especially pronounced in Science and Social Studies.

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In Kindergarten students develop foundational knowledge in a variety of mathematical areas through hands-on materials and a number of different kinds of manipulatives. Math is integrated in many activities throughout the day.

### Units of Study- Key Content--Essential Questions

**Numbers and Numeration:** Rote counting; rational counting; place values and notation; meaning and use of fractions; equivalent names for whole numbers; and comparing and ordering numbers.

- What is the repeated pattern in our number system and how many different ways can a quantity be counted? How many different ways can a number be represented?

**Operations and Computation:** Addition and subtraction procedures.

- What do we need to do to find the answer to a problem? How can you illustrate the problem using manipulatives?

**Measurement and Reference Frames:** Length and weight; units and systems of measurement; money; and time.

- What would be the best measurement tool to use to find the answer we need? How many times can you do an activity in a specified amount of time? How many

### Concepts, Understandings, and Skills

- Verbally counts 20 or more objects in a random arrangement
- Performs interrupted verbal counting beyond 100
- Counts backward from 20 or higher
- Counts by 2's beyond 20
- Counts by 5's beyond 100
- Counts by 10's beyond 100
- Reads any number 100 or less
- Writes any number 100 or less
- Understands basic meanings of addition and subtraction
- Understands 2-digit numbers in terms of 10's and 1's

pennies make a nickel? a dime? a quarter? a dollar? How many different ways do we measure time? Which measurement of time is the best to use in a given situation?

**Data and Chance:** Data collection and representation; data analysis; qualitative and quantitative probability.

- What information can you learn from a graph or chart? How many tries might it take to meet the goal?

**Algebra, Patterns, and Functions:** Patterns and functions; algebraic notation and solving number sentences; properties of arithmetic operations; word problems.

- What is the repeated pattern in our number system and how are number patterns represented on a grid? What is the question if the answer is given? How do you write a math sentence that describes the arrangement of your manipulatives?

**Geometry:** Plane and solid figures; transformations and symmetry; spatial relationships.

- How many sides and corners (or angles) does each 2 dimensional shape have and how many 2 dimensional shapes can you see in 3 dimensional shapes? Predict how a 3 dimensional shape will look when it is unrolled or flattened and can you name the shape that the unfolded form will create when it is put together?

- Recognizes many non-computational uses of numbers through daily experiences
- Estimates comfortably
- Identifies and uses measuring tools for linear, weight, and volume measures
- Performs simple data collection and graphing
- Has experiences with basic geometry shapes and symmetry concepts
- Knows the value of a penny, nickel, dime, and quarter
- Estimates time on an analog clock using hour hand only

# MATH

## Grade I

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Grade one math develops a concrete awareness of using and applying math in everyday life. In addition, students move into the field of abstract concepts through numerical representation of quantities. It enriches of the foundation of mathematical processes and their applications.

### Units of Study- Key Content--Essential Questions

**Numbers and Numeration:** Rote counting; rational counting; place values and notation; meaning and use of fractions; number theory; equivalent names for whole numbers; equivalent names for whole fractions, decimals, and percents; and comparing and ordering numbers.

- How do we use counting in everyday life and when is appropriate to estimate?  
What do we know about fractions in the real world and how are they commonly used?

**Operations and Computation:** Addition and subtraction procedures; addition and subtraction facts; multiplication and division procedures; computational estimation; and models for operations.

- How are addition and subtraction related?

**Measurement and Reference Frames:** Length, weight and angles; area, perimeter,

### Concepts, Understandings, and Skills

- Identify patterns and apply them to real-life situations
- Recognize, formulate, and solve problems that call for addition and subtraction
- Tell time to the nearest half hour
- Demonstrate amount of money can be represented in different ways
- Understand, create, and interpret a line plot and a data table
- Identify a unit appropriate for measuring and using it correctly
- Use logic to give a reasonable estimate
- Identify and describe basic shapes and solids

volume, and capacity, units and systems of measurement; temperature; money; and time.

- How can we use our own body to measure and why is standard measurement important? What is area and how do we use it? How does knowledge of money help us in our daily lives and why do we need to know about money? How do you read a thermometer and how does temperature affect the kinds of clothes we need to wear? How does time affect our daily lives and what activities do we do at various times of the day/evening?

**Data and Chance:** Data collection and representation; data analysis; qualitative and quantitative probability.

- What are different ways of collecting data and what are the different ways to record/read data? What is the likelihood of something happening and what is most likely to happen?

**Algebra, Patterns, and Functions:** Patterns and functions; algebraic notation and solving number sentences; properties of arithmetic operations; word problems.

- What is a pattern and how can you make your own patterns? Where do we see patterns in our world and what are their functions? How do you compare numbers (greater, less than, equal)?

**Geometry:** Lines and angles: plane and solid figures; transformations and symmetry.

- Why do we use a straightedge? What is a polygon and what is a non-polygon? Where can we find shapes in our everyday world and what are the characteristics of symmetry?

- Describe parts of a whole using the fractions; whole, half, and quarter
- Understand place value for ones, tens, and hundreds

# MATH

## Grade 2

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In second grade we enrich and extend our understanding of basic operations. Students are introduced to multi-digits and addition/subtraction operations. We also introduce fractions and extend concepts related to the making of change. We present the concept of multiplication and division using manipulatives.

Units of Study- Key Content--Essential Questions	Concepts, Understandings, and Skills
<p><b>Numbers and Numeration:</b> Counting, place values and notation; meaning and use of fractions; number theory; equivalent names for whole numbers; equivalent names for whole fractions, decimals, and percents; and comparing and ordering numbers.</p> <ul style="list-style-type: none"> <li>• What is the connection between ones, tens, and hundreds?</li> </ul> <p><b>Operations and Computation:</b> Addition and subtraction procedures; addition and subtraction facts; multiplication and division procedures; multiplication and division facts; computational estimation; and models for operations.</p> <ul style="list-style-type: none"> <li>• What is the connection between addition and subtraction? What is the relationship between multiplication and addition? What is the relationship between division and subtraction?</li> </ul> <p><b>Measurement and Reference Frames:</b> Length, weight and angles; area, perimeter, volume, and capacity, units and systems of measurement; temperature; money; and time.</p> <ul style="list-style-type: none"> <li>• Why is measurement important and what is the difference between metric and</li> </ul>	<ul style="list-style-type: none"> <li>• Identify patterns and apply them to real-life situations</li> <li>• Recognize, formulate, and solve problems that call for addition and subtraction</li> <li>• Tell time to the nearest five minutes</li> <li>• Demonstrate amount of money can be represented in different ways</li> <li>• Understand, create, and interpret a data table, line plot, bar graph, and a circle graph</li> <li>• Identify a unit appropriate for measuring and using it correctly</li> <li>• Use logic to give a reasonable estimate</li> <li>• Identify and describe basic shapes and solids</li> </ul>

the US customary system? How do we apply measurements (area, perimeter) to real life situations? What is the process for adding monetary amounts and how does a person make change? How do you calculate the difference between two temperatures and what are the systems for reporting temperature? How do you tell time and how does a person calculate time intervals?

**Data and Chance:** Data collection and representation; data analysis.

- What are different ways of depicting data and how can you compare data?

**Algebra, Patterns, and Functions:** Patterns and functions; algebraic notation and solving number sentences; properties of arithmetic operations.

- What is the function of a pattern? What strategies can you use to solve operations using addition, subtraction, multiplication, and division? How do you decide what the best strategy is to solve a problem?

**Geometry:** Lines and angles; plane and solid figures; transformations and symmetry.

- What is the difference between a line and a line segment? What is the difference between 2- and 3-dimensional shapes? What is symmetry? Where do we find symmetry in everyday life?

and symmetry

- Describe parts of a whole using fractions beyond whole, half and quarter
- Understand place value for ones, tens, hundreds, and thousands

# MATH

## Grade 3

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Understanding the concept of multiplication and division using single digit numbers are an important part of third grade math. Most students learn how to find equivalent fractions and how to convert improper fractions into mixed number and vice versa. Math groups are very fluid and may change after each unit to allow for differentiated instruction to meet specific student needs.

### Units of Study- Key Content--Essential Questions

- Numbers and Numeration:** Whole numbers; money and decimals; fractions.
- Why is it important to know place value and how do you use decimals correctly when working with money?
- Operations and Computation:** Addition and subtraction; addition and subtraction with decimals; multiplication and division.
- What is the connection between addition and subtraction? What is the relationship between multiplication and division?
- Measurement and Reference Frames:** Length; perimeter; money; and time.
- Why is measurement important and how do we apply measurements (area, perimeter) to real life situations? Can you count and give change back for a given amount of money?

### Concepts, Understandings, and Skills

- Knowledge of all number facts (adding, subtracting, multiplying and dividing)
- Place value
- Variety of strategies for computation
- Characteristics of 2 and 3 dimensional figures
- Estimation
- Demonstrate the use of money in real life situations
- Communication of math ideas in writing and orally
- Problem solving by utilizing different strategies

<p><b>Data and Chance:</b> Data collection and representation; data analysis.</p> <ul style="list-style-type: none"> <li>• What are different ways of depicting data and how can you compare data? How do we display data so it makes sense? Why is it important to be able to read charts and graphs?</li> </ul> <p><b>Algebra, Patterns, and Functions:</b> Visual patterns; number patterns; functions; number sentences and equations; inequalities and expressions.</p> <ul style="list-style-type: none"> <li>• What is the relationship between multiplication and division? What is the purpose of parentheses? How does the coordinate grid help to locate and read things on a map? How do you determine what to do to solve a number sentence?</li> </ul> <p><b>Geometry:</b> 2-dimensional shapes (polygons), 3-dimensional shapes, symmetry, congruence and similarity; points, lines and angles.</p> <ul style="list-style-type: none"> <li>• What are the differences between lines, line segments and rays? What are the similarities and differences between symmetry and congruence? How are geometric shapes related and what is the difference between 2 and 3 dimensional shapes?</li> </ul>	<ul style="list-style-type: none"> <li>• Customary, metric measurement, and non-standard units of measurement</li> <li>• Fractions and decimals</li> </ul>
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# MATH

## Grade 4

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In fourth grade, students work extensively on multiplication and division of multi-digit numbers using a variety of algorithms (problem solving procedures). Students also learn how to represent parts of the whole through fractions, decimals, and percents. Math groups may move at different paces to allow for differentiated instruction to meet specific student needs and to reinforce concepts.

### Units of Study- Key Content--Essential Questions

**Numbers and Numeration:** Whole numbers, money and decimals, fractions, positive and negative numbers and percentages.

- Why is it important to understand the use of place value and how is place value used in daily life?

**Operations and Computation:** Addition and subtraction; addition and subtraction with decimals; multiplication and division; multiplication and division with decimals; multiplication and division with fractions; ratio, proportion, and percent.

- How can you determine the reasonableness of an answer? What strategies are used in determining when you should subtract, multiply, divide whole and decimal numbers? What operations are needed to solve a story problem?

**Measurement and Reference Frames:** Length, capacity, volume, weight, perimeter, area, money, time.

### Concepts, Understandings, and Skills

- Know addition, subtraction, multiplication, and division facts
- Use various procedures for adding, subtracting, multiplying and dividing
- Know the relationship between multiplication and division
- Utilize different operations for problem-solving
- Begin to understand fractions, decimals, and percents, and apply them in problem-solving
- Name and classifies characteristics of various geometric shapes
- Compute area and perimeter of polygons

- How can we use formulas to determine the area and perimeter of different shapes? What are the different ways to measure and how does a person determine the proper method of measurement in daily life situations? What is the difference between area and perimeter and in what situations would require you to use each?

**Data and Chance:** Collecting/recording/displaying/evaluating data, probability and chance.

- How do people use graphs, charts and maps in daily life? What are ways that data is displayed and how do we interpret the data so that it is useful and make sense?

**Algebra, Patterns, and Functions:** Visual patterns, number patterns, sequences, functions, number sentences and equations, inequalities and expressions, integers (positive/negative numbers).

- How do you decide what operation to use to solve for “x”? How do you use a rule to complete a pattern and how you use a pattern to solve for a rule? What is the order in which you need to solve a problem with parentheses? How do you use symbols to compare number?

**Geometry:** 2-dimensional shapes, 3-dimensional shapes, symmetry, points, lines and angles.

- How do you classify shapes according to their properties? How do you use tools to measure and draw angles, rays, points, lines, and line segments?

- Recognize when estimation is necessary and reasonable
- Make and interpret a variety of graphs
- Measure with metric and customary systems

# MATH

## Grade 5

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Students in fifth grade begin to address more complex mathematical concepts by reviewing and building on previously gained knowledge. As students take a closer look at specific concepts they will apply a deeper level of thinking (comparison, analysis, and synthesis) to how problems are approached and solved.

### Units of Study- Key Content--Essential Questions

**Numbers and Numeration:** Whole numbers, money and decimals, fractions, positive and negative numbers, ratio, proportion, and percentages.

- How does place value assist in further understanding computations skills (exp. carrying and borrowing)? How does rounding money and estimating assist students in their everyday lives? When is it useful to record numbers as fractions and when is it more useful to record numbers as decimals? How do positive and negative numbers connect with other mathematical operations? What is the relationship between fractions, decimals, and percentages?

**Operations and Computation:** Addition and subtraction; addition and subtraction with decimals; addition and subtraction with fractions; multiplication and division; multiplication and division with decimals; multiplication and division with fractions; PEMDAS (order of operations); ratio, proportion, and percent.

- What algorithm works best for “me?” Why do we “carry” in addition and

### Concepts, Understandings, and Skills

- Solve problems using a variety of strategies
- Communicate mathematical ideas orally and in writing
- Know number facts for all operations
- Collect, organize, and analyze data
- Demonstrate understanding of number theory
- See relationship between estimation and computation
- Use measurement skills to understand geometric properties
- Understand relationship between fractions,

“borrow” in subtraction? Why do we need a common denominator to perform the operations? What does the numerator and denominator signify? What is the relationship between multiplication and division? Why do fractions get smaller rather than larger when we multiply? Why is it important to follow the order of operations and how do solutions change when order of operation is not followed? When are parentheses needed and when can they be left out?

**Measurement and Reference Frames:** Length, capacity, volume, weight, perimeter, area, money, time.

- How are capacity and volume related and how are volume and surface area connected? Why is it important to calculate perimeter and area and what is the connection between the two? How does surface area relate to area? When would estimating money be used in your life and why would you calculate unit price? How do different units of time connect?

**Data and Chance:** Collecting/recording/displaying/evaluating data, probability and chance.

- Why would someone want a random sampling? Why are landmarks (max., min., median, range, mean) important when looking at data? How do you determine which way to display your data and which displays best convey your specific information? When do you use specific data landmarks and how can landmarks be used when reading a chart? What makes something fair or unfair? When is probability used? How are the terms: very likely, impossible, unlikely, 50-50, likely, very likely, guaranteed connected?

**Algebra, Patterns, and Functions:** Visual patterns, number patterns, sequences, functions, number sentences and equations, inequalities and expressions, integers (positive/negative numbers).

- When would visual patterns be useful and how do patterns help interpret data? How do tables help organize data and when would you use a table? What is the purpose of using a variable? When in everyday life do you compare inequalities? How do operations change when negative numbers are involved and why do operations change when negative numbers are involved?

decimals, and percents

**Geometry:** 2-dimensional shapes, 3-dimensional shapes, symmetry, points, lines and angles.

- How are geometric shapes related? What properties are found in all polygons and why is a circle not a polygon? Why is  $\pi$  important to properties of a circle? What is the difference between a face and a base? What 2-dimensional polygon properties translate to 3-dimensional shapes? When in everyday life do you use 3-dimensional shapes? What is the difference between rays, lines, and line segments? Where is the measurement of angles used in everyday life? When would you use a half-circle protractor as opposed to a full-circle protractor? How do relationships between angles allow one to determine the measure of an angle? How are vertical and adjacent angles related to the various angle types and what are their measurement relationships?

# MATH

## Grade 6

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Mastery of concepts coupled with the requisite skills is the primary focus of the year. At the end of sixth grade, students at all levels will be prepared to begin or continue their studies in higher level mathematics.

### Units of Study- Key Content--Essential Questions

**Numbers and Numeration:** Whole numbers, fractions, decimals, percents, positive and negative numbers.

- How can an understanding of place value inform work with decimals and scientific notation? What is the relationship between fractions, mixed numbers, decimals, and percents? What are the advantages and disadvantages of working with numbers in each of those forms? What's the relationship between a number and it's reciprocal? What's the relationship between positive and negative numbers and how can positive and negative numbers be added, subtracted, multiplied, and divided?

**Operations and Computation:** Addition and subtraction with decimals and fractions; multiplication and division with decimals and fractions; negative numbers; ratio, proportion, and percent.

- How do I use the four main operations in every aspect of mathematical computation and how does an understanding of place value influence the four

### Concepts, Understandings, and Skills

- Communicate mathematical ideas orally and in writing
- Use patterns and tables to solve for unknowns
- Make reasonable estimates as a first step in problem solving
- Practice mental math computation strategies
- Draw graphs accurately
- Convert decimals to fractions and percents
- Measure angles with a protractor
- Calculate supplementary angles without a protractor when one angle is given
- Read, write, and understand place value in very large and very small numbers.
- Understand and apply scientific and

main operations? How do negative integers affect the outcomes of these operations? How do I use negative numbers with fractions and decimals? How do I use variables with these operations? How can I use algorithms to gain mastery over multiple operations? What are the rules of divisibility and how do I apply them? How can I tell if my answer is reasonable?

**Measurement and Reference Frames:** Linear measurement; capacity and volume; weight; perimeter, area, diameter and circumference; money; angles and coordinate grids; time and temperature.

- How do these basic forms of measurement impact my understanding of math concepts such as fractions, decimals, percents and graphs? How does an understanding of the formulae for area, perimeter, diameter and circumference allow me to extend these ideas into equations with variables, graphing for unknown quantities and geometric expressions? How does an understanding of the computations involved in these areas impact my ability to understand word problems and accurately choose the correct operations to perform?

**Graphing and Data Collection:** Graph types; graphing points; word and story problems; graph interpretation; scientific integration; language arts integration.

- What types of graphs work best for different kinds of information? How do the median, mean and mode enable one to correctly interpret certain information? How can facts and statistics be manipulated depending on the type of graph being used and how can the reader tell if information in a graph is accurate and factual? How do these types of graphs lead to coordinate plotting and to an understanding of the use of formulae in higher level graphs (e.g. algebra, geometry)?

**Probability and Chance:** Probability of equally/likely outcomes; random numbers; tools (Venn and Tree Diagrams); scientific integration; language arts integration.

- What tools can I use to determine probability and how accurate are these tools? What are random numbers and how do I use them efficiently? How can I use probability tools to better understand graphs, data interpretation and fractions? What is the connection between the number of trials in an experiment and the

exponential notations.

- Understand negative exponents
- Find equivalent fractions and mixed numbers.
- Convert between fractions, mixed numbers, decimals, and percents
- Find reciprocals of numbers.
- Add, subtract, multiply and divide positive and negative whole numbers, fractions, and decimals.
- Estimation
- Computation
- Problem Solving
- Problem Solving through multi-steps and multi-operations
- Check work through use of opposite operations
- Equivalencies
- Application of Algorithms
- Calculation of rate and percent
- Create one-step equations using variables. fractions, decimals, and percents
- Understand and use more than one procedure to find the correct answer for each operation.
- Apply “reasonableness” test to all answers
- Identify equivalent customary metric units of length.
- Analyze new material based on appropriate formulae.
- Record/compare numerical data.
- Organize / tabulate survey data.

results? How does the number of trials affect the outcomes of different experiments? What do the rules of probability teach me about taking multiple choice tests?

**Algebra, Patterns, and Functions:** Visual patterns, number patterns, sequences, functions, number sentences and equations, inequalities and expressions, integers (positive/negative numbers).

- What is the role of a variable in an equation? What is the connection between number patterns and algebraic expressions? How can I find the next term in a sequence? What role does the order of operations and fraction theory play in understanding patterns, functions and algebraic expressions? What are square roots and what connection do they have to functions?

**Geometry:** 2-dimensional shapes; 3-dimensional shapes; symmetry; congruency and similarity; points, lines and angles; tessellations and tangrams.

- What is the role of congruence in geometry? How does understanding congruence enable students to better understand geometric concepts and applications? What is the relationship between angles in geometric figures and the concepts of perpendicular and congruence?

- Collect and compare rate data.
- Correctly create, read, and use a variety of graphs
- Predict and record Outcomes
- Calculate Probabilities
- Design Simulations and Experiments
- Apply the concept of random numbers to probability situation
- Explore and extend visual patterns.
- Define and create tessellations/frieze patterns.
- Identification of forms, angles, types of geometric shapes
- Shape manipulation through tessellations, tangrams and pentominos
- Apply the order of operations to evaluate expressions and solve number sentences.
- Determine the value of a variable.
- Apply the distributive property.
- Write algebraic expressions to describe situations.

# MATH

## Grade 6-7

### Transition Math

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In Transition Math, students move from the concrete to the abstract. The students build on their internal number sense and fundamental skills acquired throughout the lower grades and apply them to mathematical expressions and equations using unknowns. Throughout the curriculum, real-life situations are explored to enable the students to understand the relevance as well as to gain concrete mastery of the material.

#### Units of Study- Key Content--Essential Questions

**Reading and Writing Numbers:** Order of operations (PEMDAS); identifying positive and negative numbers; rational numbers and uses; powers of ten and scientific notation.

- Why and how are numbers represented in different ways? What is the purpose of scientific notation? Why is our number system based on the number 10? What do negative numbers mean in story problems/real life?

**Using Variables:** Identifying and describing patterns; writing algebraic expressions; evaluating algebraic expressions; using formulas, solving open sentences and inequalities using substitution.

- What instances would call for the use of a variable instead of an actual number? What constitutes a pattern? What is the difference between algebraic expressions and equations? How are mathematical formulas created and when/why do we use them in real life?

#### Concepts, Understandings, and Skills

- Shows ability to correctly use the vocabulary of mathematics
- Shows work and steps in solving problems
- Consistently checks over work
- Performs calculations with whole numbers, fractions, and decimals
- Solves simple algebraic equations
- Applies algebraic principles to real world situations
- Interprets and completes formulas and graphs
- Solves problems using geometric concepts
- Perform arithmetic operations using

**Representing Numbers:** Add, subtract, and compare fractions; add, subtract, and compare decimals; fraction, decimal and percent equivalence; estimation.

- What are the various forms of “Part of a Whole”? And how do manipulate and move between them? When is it more efficient (in real life) to use: a. fraction b. decimal c. percent? When is estimation useful?

**Sets of Numbers and Shapes:** Add and subtract positive and negative numbers; Solving  $x + a = b$ ; Solving  $x + a < b$ ; Graphing  $x + y = k$

- How are addition and subtraction related? What steps are followed to solve an equation with an unknown quantity if it is too complicated to do as mental math? How do you take information, establish what the unknown is, and create an algebraic equation to represent it? What is the difference between an equation and inequality, and when do you use each in real life situations? How can a line be a solution to an equation?

**Geometry Ideas:** Translations; Reflections and Reflection Symmetry; Tessellations; Angles and Lines; Angles and Parallel Lines; Properties of Parallelograms; The Triangle-Sum Property

- How does the measure of one angle determine the measure of its adjacent angle? Why are vertical angles equal to one another? How do the properties of angles play our in the properties of various shapes?

**Multiplication in Geometry:** The Area Model for Multiplication; Multiplication of Fractions; The Distributive Property; The Area of a Triangle; The Area of a Trapezoid; Circles; The Size-Change Model for Multiplication

- What is the difference between area and perimeter? Why does the number get smaller when you multiply fractions? How do the formulas for area for different shapes relate to one another? How is the distributive property realized in the real world?

**Multiplication in Algebra:** Multiplication and Division with Negative Numbers; Solving  $ax = b$ ; Solving  $ax + b = c$ ; Graphing  $y = ax + b$

- How are multiplication and division related? What steps are followed to solve an

grouping symbols and the rules for order of operation to evaluate numerical expressions.

- Interpret real life situations with positive, negative and zero.
- Graph and read numbers on a number line.
- Know the definition of a rational number.
- Write a description of patterns using variables.
- Write a numerical or algebraic expression.
- Evaluate algebraic expressions given the values of all variables in them.
- Calculate the value of a variable given the value of other known variables in a formula.
- Use the Pythagorean Theorem to find distances in real life situations.
- Use fractions to answer questions in real situations.
- Order and compare and convert among decimals, fractions and percents.
- Deal with estimates in real situations.
- Calculate absolute value.
- Solve  $x + a = b$  using steps of adding/ subtracting on each side of the equation to isolate the variable.
- Substitute in values for  $x$  to determine  $y$  for equations
- Translate and reflect figures on a coordinate graph.
- Determine reflection and rotation symmetries of a figure.
- Create tessellations of polygons.
- Use properties of lines and angles to

equation with an unknown quantity if it is too complicated to do as mental math? How do you take information, establish what the unknown is, and create an algebraic equation to represent it?

**Patterns Leading to Division:** Integer Division; The Rate Model for Division; Division of Fractions; Division with Negative Numbers

- How are multiplication and division related? What is a reciprocal? Why do we multiply by a reciprocal and divide? How can this be explained with manipulatives or in real life situations? How are rates and ratios used in real life? How do we use proportions in everyday thinking?

**Linear Equations and Inequalities:** Finding Solutions Using Graphs; Solving  $ax + b = cx + d$ ; Solving  $ax + b < cx + d$ ; Linear Combinations; Graphing  $Ax + By = C$ ; Time-Distance Graphs; Graph of Formulas.

- How is a line a solution to a linear equation? And what does the line tell us about real world situations? How do equations and inequalities compare? Why do we use graphs? What information is more useful to graph?

**Statistics and Variability:** Representing Categorical Data; Properties of the Mean

- What are the different ways you can represent/picture categorical data? And...Why and when each of these representations/pictures useful? What is the difference between median and mean? Why are means often not whole numbers?

determine angle measures.

- Use properties of lines and angles to determine angle measures.
- Find the area of a triangle given appropriate dimensions.
- Find the area of a trapezoid
- Recognize and use the Distributive Property and the Commutative and Associative Properties of Multiplication.
- Multiply fractions.
- Find the area of a triangle given appropriate dimensions.
- Find the area of a trapezoid (including special types) given appropriate dimensions.
- Find the area and circumference of a circle. Recognize the differences between perimeter and area.
- Apply the Size-Change Model for Multiplication
- Multiply and divide positive and negative numbers.
- Solve and check equations by multiplying or dividing each side by a coefficient.
- Graph equations in the form of  $y = ax + b$  by substituting in values for  $x$ .
- Use integer division
- Use the Rate Model for Division
- Divide fractions with numbers or variables.
- Divide positive and negative numbers.
- Solve equations and inequalities using the Division Property of Inequality.
- Use the Ratio-Comparison Model of

Division.

- Solve inequalities
- Translate situations of constant increase or decrease
- Translate situations of linear combinations
- Graph situations involving time and distance.
- Graph a formula.
- Interpret information displayed in bar graphs, circle graphs, histograms, and stem-and-leaf displays.

# MATH

## Grade 7-8

### Algebra

The Day School mathematics program strives to develop the basic concepts and skills that are used by students in their daily lives. The curriculum, aligned to NCTM (National Council of Teachers of Mathematics) standards, requires students to refine problem-solving skills through accurate conceptual and procedural knowledge and their practical applications. Mathematical reasoning is expanded through oral and written discussion to problems across the disciplines, but is especially pronounced in Science and Social Studies.

The core set of curricular materials for the majority of students is Everyday Mathematics and its middle school extension, Transition Mathematics, Algebra and Discovering Geometry. The program is specifically designed to provide a spiral curriculum that revisits topics at ever increasing levels of depth. Enrichment and enhancement activities are provided within the core materials. In addition, at all grade levels teachers supplement curricular materials to provide challenges as well as reinforcement of important skills and concepts. These alternative approaches allow each student experiences that meet their individual learning needs. At all grade levels high achieving students are challenged with materials that may include upper level high school concepts and activities.

The focus of the seventh and eighth grade algebra is on the use of variables in all operations with multiple step equations. The course is used to explore the large range of applications in the everyday world and prepare students for higher level mathematics.

#### Units of Study- Key Content--Essential Questions

**Variable/Properties/Formulas/Expressions:** Evaluating Expressions; Describing Patterns; Equivalent Expressions; Picturing Expressions; Absolute Value and Distance; Data and Spread; Distributive Property and Removing Parentheses; Distributive Property and Adding Like Terms; Explaining Number Puzzles; Opposites; Explaining Addition and Subtraction Related Facts; Explaining Multiplication and Division Related Facts

- Why use variables and what is the purpose of using variables? What is the purpose of simplifying a problem versus solving the problem? How do the rules (properties/formulas) that are already known translate into universal properties using variables?

**Linear Equations and Inequalities:** Graphing Linear Patterns; Solving Equations with Tables and Graphs; Solving Equations by Creating Equivalent Equations; Solving  $ax + b = c$ ; Using the Distributive Property in Solving Equations; Inequalities and Multiplication;

#### Concepts, Understandings, and Skills

- Shows ability to correctly use the vocabulary of mathematics
- Shows works and steps in solving problems
- Consistently check over work
- Show ability to solve a variety of algebraic equations
- Can relate equations to graphs as well as graphs to equations
- Applies algebraic principles to real world situations
- Understands divisions and proportions in algebra (rates, ratio, and probability)
- Shows proficiency with whole numbers,

Solving  $ax + b < c$ ; Solving Equations by Clearing Fractions; Solving Percent Problems Using Equations; Horizontal and Vertical Lines; Using Tables and Graphs to Solve; Solving  $ax + b = cx + d$ ; Solving  $ax + b < cx + d$

- What steps are followed to solve an equation with an unknown quantity if it is too complicated to do as mental math? How do you take information, establish what the unknown is, and create an algebraic equation to represent it? What is the difference between an equation and inequality, and when do you use each in real life situations? How is a line a solution to an equation? How do percents play a role in our everyday life?

**Slopes and Lines:** Rate of Change; The Slope of a Line; Properties of Slope; Slope-Intercept Equations for Lines; Equations for Lines with a Given Point and Slope; Equations for Lines through Two Points; Standard Form of the Equation of a Line

- What is the relationship between rate of change and slope? What is the reason for the various equation formulas for lines, and for what given sets of information would one use each formula? What do horizontal and vertical lines look like? What is the relationship (in terms of equations) between a perpendicular line and parallel line? What real situations call for understanding of slope and pitch?

**Powers and Roots:** Multiplication Counting Principle; Products and Powers of Powers; Quotients of Powers; Negative Exponents; Powers of Products and Quotients

- What is the meaning of a base number and what is the meaning of the exponent? Why does the shortcut of adding exponents/subtracting exponents in a multiplication/division problem work? Why does the shortcut of multiplying the exponents work in a problem in which you raise the exponent to a power? Why is a negative exponent a fraction and not a negative number?

**Quadratic Equations and Functions:** The Function with Equation  $y=ax^2$ ; Solving  $ax^2 = b$ ; The Quadratic Formula; Analyzing Solutions to Quadratic Equations

- Why is a graph of the equation of the form  $y=ax^2$  always above the x axis? Why does a square root problem always have a positive and negative answer? Why/How does the Quadratic Formula work? What cases call for it?

fractions, and decimals

- Evaluate numerical and algebraic expressions.
- Use variables to describe patterns in instances or tables.
- Use graphs to determine whether expressions seem to be equivalent.
- Evaluate expressions involving absolute value.
- Calculate the range and mean absolute deviation.
- Use the Distributive Property to expand and combine like terms.
- Apply and recognize the following multiplication properties: Multiplicative Identity Property, Multiplicative Inverse Property, Multiplication Property of Zero, Multiplication Property of Equality, and the Zero Product Property.
- Use linear equations and inequalities
- Apply the Addition and Multiplication Properties of Equality and Inequality.
- Graph all the solutions to a linear inequality.
- Solve percent problems.
- Use tables and graphs to solve real-world problems involving linear situations.
- Calculate rates of change from real data and describe their real-world meanings.
- Find the slope of the line through two given points.
- Use the definition and the properties of slope.

**Linear Systems:** Solving Systems Using Substitution; More Uses of Substitution; Solving Systems by Addition; Solving Systems by Multiplication

- How is an ordered pair a solution to a linear system? When are two lines parallel? At what point do two lines intersect? What does it mean when two different equations can have a common solution?

**Polynomials:** Investments and Polynomials; Classify Polynomials; Multiplying a Polynomial by a Monomial; Common Monomial Factoring; Multiplying Polynomials; Specials Binomial Products

- How do you calculate an annuity? Can you figure out compound interest? How do you figure out problems involving periodic investments or withdrawals? What is a polynomial? What is a monomial? What is a binomial?

**Quadratics:** Factoring  $x^2 + bx + c$ ; Which Quadratic Expressions are Factorable? Factoring and Rational Expressions

- When do you need to have an expression in the quadratic form and when is it best to have it in factored form? How are rational expressions and simple fractions related to one another?

- Use equations for lines to describe real situations.
- Use powers to count the number of sequences possible for repeated choices.
- Simplify products, quotients, and powers of powers.
- Evaluate negative integer powers of real numbers.
- Rewrite powers of products and quotients.
- Graph equations of the form  $y=ax^2$  and interpret these graphs.
- Use quadratic equations to solve problems about paths of projectiles.
- Solve geometric problems involving quadratic equations.
- Solve systems using substitution.
- Solve systems by addition and multiplication.
- Add and subtract polynomials. Translate investment situations into polynomials.
- Classify polynomials by their degree or number of terms.
- Multiply polynomials. Represent polynomials by areas.
- Find common monomial factors of polynomials.
- Determine whether a quadratic polynomial can be factored over the integers.
- Determine whether a quadratic polynomial can be factored over the integers.
- Use factoring to write rational expressions in lowest terms.