# Mendham Township School District

Mathematics Curriculum - 2012

## Grade 7 General & Advanced

In Grade 7, instructional time should focus on four critical areas: (1) developing understanding of and applying proportional relationships; (2) developing understanding of operations with rational numbers and working with expressions and linear equations; (3) solving problems involving scale drawings and informal geometric constructions, and working with two- and three-dimensional shapes to solve problems involving area, surface area, and volume; and (4) drawing inferences about populations based on samples.

1. Students extend their understanding of ratios and develop understanding of proportionality to solve single- and multi-step problems. Students use their understanding of ratios and proportionality to solve a wide variety of percent problems, including those involving discounts, interest, taxes, tips, and percent increase or decrease. Students solve problems about scale drawings by relating corresponding lengths between the objects or by using the fact that relationships of lengths within an object are preserved in similar objects. Students graph proportional relationships and understand the unit rate informally as a measure of the steepness of the related line, called the slope. They distinguish proportional relationships from other relationships.

2. Students develop a unified understanding of number, recognizing fractions, decimals (that have a finite or a repeating decimal representation), and percents as different representations of rational numbers. Students extend addition, subtraction, multiplication, and division to all rational numbers, maintaining the properties of operations and the relationships between addition and subtraction, and multiplication and division. By applying these properties, and by viewing negative numbers in terms of everyday contexts (e.g., amounts owed or temperatures below zero), students explain and interpret the rules for adding, subtracting, multiplying, and dividing with negative numbers. They use the arithmetic of rational numbers as they formulate expressions and equations in one variable and use these equations to solve problems.

3. Students continue their work with area from Grade 6, solving problems involving the area and circumference of a circle and surface area of three-dimensional objects. In preparation for work on congruence and similarity in Grade 8 they reason about relationships among two-dimensional figures using scale drawings and informal geometric constructions, and they gain familiarity with the relationships between angles formed by intersecting lines. Students work with three-dimensional figures, relating them to two-dimensional figures by examining cross-sections. They solve real-world and mathematical problems involving area, surface area, and volume of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes and right prisms.

4. Students build on their previous work with single data distributions to compare two data distributions and address questions about differences between populations. They begin informal work with random sampling to generate data sets and learn about the importance of representative samples for drawing inferences.

## *Grade 7 Overview*

- **Ratios and Proportional Relationships**
  - Analyze proportional relationships and use them to solve real-world and mathematical problems.

- **The Number System**
  - Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.

- **Expressions and Equations**
  - Use properties of operations to generate equivalent expressions.
  - Solve real-life and mathematical problems using numerical and algebraic expressions and equations.

- **Geometry**
  - Draw, construct and describe geometrical figures and describe the relationships between them.
  - Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.

- **Statistics and Probability**
  - Use random sampling to draw inferences about a population.
  - Draw informal comparative inferences about two populations.
  - Investigate chance processes and develop, use, and evaluate probability models.

- **Mathematical Practices**
  1. 1. Make sense of problems and persevere in solving them.
  2. 2. Reason abstractly and quantitatively.
  3. 3. Construct viable arguments and critique the reasoning of others.
  4. 4. Model with mathematics.
  5. 5. Use appropriate tools strategically.
  6. 6. Attend to precision.
  7. 7. Look for and make use of structure.
  8. 8. Look for and express regularity in repeated reasoning.

The following chart details the 7th grade curricular focus and is broken out into areas of content, skills, and concepts:

| CCCS | CCCS# | Comp & Content | Skills | Concepts |
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| **Ratios and Proportional Relationships 7RP** | | | | |
| **Analyze proportional relationships and use them to solve real-world and mathematical problems** | | | | |
| Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. For example, if a person walks 1/2 mile in each 1/4 hour, compute the unit rate as the complex fraction 1/2/1/4 miles per hour, equivalently 2 miles per hour | 7RP1 | Unit Rate | Calculate unit rate using division and proportions | Understand unit rates |
| Recognize and represent proportional relationships between quantities. | 7RP2 | Proportion | | Understand when using a proportion is an appropriate strategy |
| Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin. | 7RP2A | | Use tables and graphs to identify proportional relationships | |
| Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships | 7RP2B | | Identify and calculate unit rates in tables, graphs, equations, diagrams, and verbal descriptions | |
| Represent proportional relationships by equations. For example, if total cost t is proportional to the number n of items purchased at a constant price p, the relationship between the total cost and the number of items can be expressed as $t = pn$. | 7RP2C | | Write an equation to model a proportional relationship | |
| 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. | 7RP2D | Real world meaning of (00) and (1, r) | | Interpret points on a graph in a real world situation |
| Use proportional relationships to solve multistep ratio and percent problems. Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error. | 7RP3 | Simple Interest<br><br>Tax<br><br>Markup<br><br>Markdown | Use proportional relationships to solve multi-step ratio and percent problems | |

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| | | Gratuity<br><br>Commission<br><br>Fees<br><br>Percent Increase<br><br>Percent Decrease<br><br>Percent Error | | |
| **The Number System 7.NS** | | | | |
| **Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers** | | | | |
| 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 | 7NS1 | | Add and subtract signed rational numbers<br><br>Represent addition and subtraction of signed rational numbers on a number line | |
| Describe situations in which opposite quantities combine to make 0. For example, a hydrogen atom has *0* charge because its two constituents are oppositely charged | 7NS1A | Additive Inverse Property | | Apply additive inverse to real world situations |
| Understand $p + q$ as the number located a distance $\|q\|$ from $p$, in the positive or negative direction depending on whether $q$ is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts. | 7NS1B | Absolute Value | | The sign of numbers being added affects the direction you travel on the number line |
| Understand subtraction of rational numbers as adding the additive inverse, $p – q = p + (–q)$. Show that the distance between two rational numbers on the number line is the absolute value of<br>their difference, and apply this principle in real-world contexts | 7NS1C | Definition of Subtraction:<br>a - b = a + (-b) | Show subtraction of rational numbers in a real world context on a number line | |
| Apply properties of operations as strategies to add and subtract rational numbers. | 7NS1D | Inverse Property of Addition<br><br>Commutative Property of Addition | Use properties to add and subtract rational numbers | |

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| | | Associative Property of Addition<br><br>Identity Property of Zero | | |
| Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers | 7NS2 | | Multiply and divide signed numbers | |
| Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as (–1)(–1) = 1 and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts | 7NS2A | The properties of multiplication apply to signed and unsigned rational numbers | Multiply signed rational numbers<br><br>Apply multiplication of rational numbers to real world situations | |
| Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If $p$ and $q$ are integers, then $–(p/q) = (–p)/q = p/(–q)$. Interpret quotients of rational numbers by describing real-world contexts. | 7NS2B | Division by zero is undefined<br><br>A negative fraction can be represented as: – (a/b), -a/b, or a/-b | Represent negative fractions | |
| Apply properties of operations as strategies to multiply and divide rational numbers | 7NS2C | Distributive Property<br><br>Multiplication Property of Zero<br><br>Inverse Property of Multiplication<br><br>Identity Property of One<br><br>Commutative Property of Multiplication<br><br>Associative Property of Multiplication | Use properties to multiply and divide rational numbers | |
| Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats | 7NS2D | Terminating Decimals<br><br>Repeating Decimals | Use long division to convert a rational number to a decimal | |

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| Solve real-world and mathematical problems involving the four operations with rational numbers | 7NS3 | | Apply rational number operations to real world situations | |
| **Expressions and Equations 7EE** | | | | |
| **Use properties of operations to generate equivalent expressions** | | | | |
| Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients. | 7EE1 | Like Terms | Combine like terms with rational coefficients<br><br>Factor out the greatest common factor from linear expressions | |
| Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related. For example, a + 0.05a = 1.05a means that "increase by, 5%" is the same as "multiply by 1.05." | 7EE2 | Multiple representations of an expression exist and can be used in different forms to facilitate problem solving | Rewrite an expression in multiple forms | |
| **Solve real-life and mathematical problems using numerical and algebraic expressions and equations.** | | | | |
| Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. For example*:* If a woman making *$25* an hour gets a *10%* raise, she will make an additional *1/10* of her salary an hour, or *$2.50*, for a new salary of *$27.50*. If you want to place a towel bar *9 3/4* inches long in the center of a door that is *27 1/2* inches wide, you will need to place the bar about *9* inches from each edge; this estimate can be used as a check on the exact computation. | 7EE3 | | Solve real-life, multi-step problems with signed rational numbers using multiple and the most appropriate strategies such as converting between forms, assessing reasonableness, using mental math and estimating | |
| 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 | 7EE4 | Write equations and inequalities from verbal models | | |
| Solve word problems leading to equations of the form $px + q = r$ and $p(x + q) = r$, where $p$, $q$, and $r$ are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. For example, the perimeter of a rectangle is *54* cm. Its length is *6* cm. What is its | 7EE4A | Understand the solution of an equation | Write a multi-step equation from a word problem<br><br>Solve equations using | |

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| width? | | | inverse operations or a replacement set | |
| Solve word problems leading to inequalities of the form $px + q > r$ or $px + q < r$, where $p$, $q$, and $r$ are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem. For example: As a salesperson, you are paid *$50* per week plus $3 per sale. This week you want your pay to be at least *$100*. Write an inequality for the number of sales you need to make, and describe the solutions. | 7EE4B | Understand the solution of an inequality<br><br>Understand how inverse operations using multiplication and division of signed numbers affects the solution of inequalities | Write an inequality from a word problem<br><br>Solve inequalities using inverse operations or a replacement set<br><br>Graph an inequality in a coordinate plane | Equations and inequalities represent different relationships between quantities |
| **Geometry 7G** | | | | |
| **Draw, construct, and describe geometrical figures and describe the relationships between them.** | | | | |
| Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale | 7G1 | Understand the concepts of scale factor and similarity<br><br>Understand how a change in scale factor affects area | Solve for missing scale or actual lengths<br><br>Solve for corresponding sides of similar figures<br><br>Reproduce a scale drawing at a different scale | |
| Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle. | 7G2 | Identify types of triangles and other basic polygons | Draw basic geometric shapes using multiple modalities (freehand, ruler, protractor) | |
| Describe the two-dimensional figures that result from slicing three dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids | 7G3 | Understand what a cross section is<br><br>Identify rectangular prisms and right rectangular pyramids<br><br>Identify basic polygons | Name the geometric figure formed by a cross section | |
| **Solve real-life and mathematical problems involving angle measure, area, surface area, and volume** | | | | |
| Know the formulas for the area and circumference of a circle | 7G4 | Identify area and | Calculate the area and | |

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| and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle | | circumference of circles and their corresponding formulas | circumference of circles<br><br>Convert between the area and circumference of circles | |
| Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure. | 7G5 | Supplementary Angles<br><br>Complementary Angles<br><br>Vertical Angles<br><br>Adjacent Angles | Write and solve simple equations from a multi-step problem to find an unknown angle in a figure | |
| 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. | 7G6 | Polygons<br><br>Cubes<br><br>Right prisms<br><br>Area of Polygons<br><br>Volume and surface area of three dimensional figures | Find the area of simple polygons<br><br>Find the volume and surface area of three dimensional figures | |
| **Statistics and Probability 7SP** | | | | |
| **Use random sampling to draw inferences about a population** | | | | |
| Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling<br>tends to produce representative samples and support valid inferences | 7SP1 | Sampling Methods<br><br>Biased Samples<br><br>Sample versus Population<br><br>Emphasis on validity of random sampling | | Make generalizations about a population from a valid sample using statistics |
| Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions. For example, estimate the mean word length in a book by randomly sampling words from the book; predict the winner of a school election | 7SP2 | | Identify a valid sample<br><br>Use sample data to draw inferences | |

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| based on randomly sampled survey data. Gauge how far off the estimate or prediction might be. | | | Gage accuracy of inferences | |
| **Draw informal comparative inferences about two populations** | | | | |
| Informally assess the degree of visual overlap of two numerical data distributions with similar variability's, measuring the difference between the centers by expressing it as a multiple of a measure of variability. For example, the mean height of players on the basketball team is 10 cm greater than the mean height of players on the soccer team, about twice the variability (mean absolute deviation) on either team; on a dot plot, the separation between the two distributions of heights is noticeable. | 7SP3 | | Comparing data sets using statistical data and/or plots | |
| Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations. For example, decide whether the words in a chapter of a seventh-grade science book are generally longer than the words in a chapter of a fourth-grade science book. | 7SP4 | | Use measures of central tendency and range to compare data sets | |
| **Investigate chance processes and develop, use, and evaluate probability models** | | | | |
| Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event. | 7SP5 | Probability can be expressed as a value ranging from zero to one – Benchmark Probabilities<br><br>Probability is a ratio of favorable outcomes to total outcomes | Assess the likelihood of an event occurring based on its relativity to zero, ½, and one. | |
| Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability. For example, when rolling a number cube *600* times, predict that a *3 or 6* would be rolled roughly *200* times, but probably not exactly *200* times | 7SP6 | Experimental versus Theoretical Probability | Use experimental probability to predict future outcomes | |
| Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy. | 7SP7 | | Create an experiment for probability<br><br>Calculate the experimental probability of the experiment<br><br>Explain the deviations | |

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| | | | (experimental versus theoretical) | |
| Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. For example, if a student is selected at random from a class, find the probability that Jane will be selected and the probability that a girl will be selected. | 7SP7A | | Calculate probability when all outcomes are equally likely | |
| Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process. For example, find the approximate probability that a spinning penny will land heads up or that a tossed paper cup will land open-end down. Do the outcomes for the spinning penny appear to be equally likely based on the observed frequencies? | 7SP7B | | Determine from an experiment whether outcomes are equally likely to occur | |
| Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation. | 7SP8 | Compound Events<br>Tree Diagrams<br>Simulations | Use organized lists, tables, tree diagrams, and simulations to calculate the probability of compound events | |
| Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs. | 7SP8A | Counting Principle | Use the counting principle to determine the probability of compound events | Understand how to use a sample space to calculate the probability of a compound event |
| Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e.g., "rolling double sixes"), identify the outcomes in the sample space which compose the event | 7SP8B | | Create an organized list, table, and tree diagram for an experiment involving compound events | |
| Design and use a simulation to generate frequencies for compound events. For example, use random digits as a simulation tool to approximate the answer to the question: If 40% of donors have type A blood, what is the probability that it will take at least 4 donors to find one with type A blood? | 7SP8C | | Create a simulation to generate frequencies for compound events | |