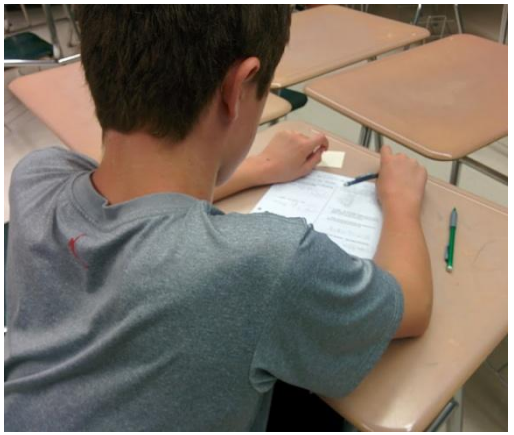
Bedford Public Schools

Grade 7 – Pre-Algebra

In 7th Grade Pre-Algebra, 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; (4) drawing inferences about populations based on samples; (5) grasping the concept of a function and using functions to describe quantitative relationships; and (6) analyzing two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and understanding and applying the Pythagorean Theorem.

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.

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



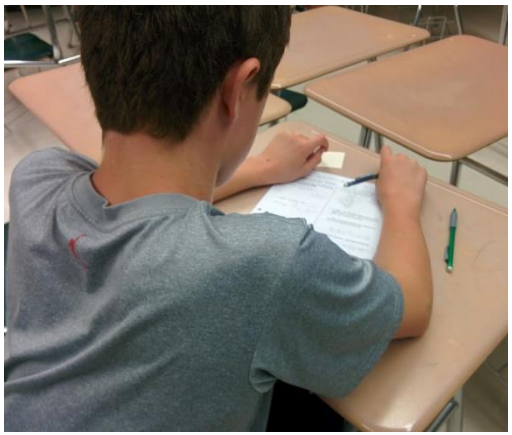
Learning Expectations

numbers as they formulate expressions and equations in one variable and use these equations to solve problems.

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.
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.

Students grasp the concept of a function as a rule that assigns to each input exactly one output. They understand that functions describe situations where one quantity determines another. They can translate among representations and partial representations of functions (noting that tabular and graphical representations may be partial representations), and they describe how aspects of the function are reflected in the different representations.

Students use ideas about distance and angles, how they behave under translations, rotations, reflections, and dilations, and ideas about congruence and similarity to describe and analyze two-dimensional figures and to solve problems. Students show that the sum of the angles in a triangle is the angle formed by a straight line, and that various configurations of lines give rise to similar triangles because of the angles created when a transversal cuts parallel lines. Students understand the statement of the Pythagorean Theorem and its converse, and can explain why the Pythagorean Theorem holds, for example, by decomposing a square in two different ways. They apply the Pythagorean Theorem to find distances between points on the coordinate plane, to find lengths, and to analyze polygons. Students complete their work on volume by solving problems involving cones, cylinders, and spheres.



Learning Expectations

The Number System

Enduring Understandings In order to meet the standards, the students will need to understand that . . .	**Essential Questions** In order to understand, students will need to consider questions such as . . .	**Knowledge and Skills** Learning this material will require students to . . .	**Standards and Assessments**
Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers. • Integers represent real world situations involving gains and losses. • Opposite numbers have the same absolute value but different signs. • Absolute value is a representation of distance. • Adding integers involves grouping or canceling. • Subtracting integers is the same as adding the opposite. • If the number of negative integers is even (odd), the product is positive (negative). • If any integer is zero, the product is zero. • The rules for dividing integers are the same as multiplying integers. • Commutative and Associative Properties are used to evaluate expressions by rearranging and simplifying. The Distributive Property provides a process to handle variables in parentheses.	• How would you compare and contrast absolute value and opposite numbers? • How does the sign of a number affect: addition, subtraction, multiplication, and division? • How can you use integers to represent real world situations? • What are the benefits of writing very large numbers and very small numbers using scientific notation? • Why is the concept of an inverse important to the process of dividing fractions? • How is the method of subtracting integers similar to the process of dividing fractions? • What makes a number irrational? • When does order matter and when does it not matter?	• Graph and order integers • Find absolute value • Add, subtract, multiply, and divide integers • Use Commutative, Associative and Distributive Properties to evaluate expressions • Identify and plot points in a coordinate plane • Use formula for perimeter and area of rectangles and triangles • Add, subtract, multiply and divide using fractions, decimals or percents • Convert between fractions, decimals, and percents and the inverse • Have automaticity in computing common fractions, decimals, and percents • Convert between Scientific Notation and Standard Form. • Convert metric measurements. • Classify real numbers • Define irrational numbers • Compare and order real numbers • Find and approximate square roots of numbers	• Chapter 2 (Integers) Test **7.EE.3**, **7.EE.4a, 7.NS.1a, 7.NS.1b, 7.NS.1c 7.NS.1d, 7.NS.2a, 7.NS.2b, 7.NS.2c, 7.NS.2d, 7.NS.3** • Chapter 4.8/7 (Scientific Notation, Metric Conversion and Ratios/Proportions/Percents) Test **7.RP.1, 7.RP.2.a, 7.RP.2b, 7.RP.2c, 7.RP.3, 7.NS.2d** • Chapter 9 (Real Numbers and Pythagorean Theorem) Test **7.NS.2b, 7.G.6, 8.G.6, 8.G.7, 8.NS.1, 8.NS.2**

Ratios and Proportional Relationships

Enduring Understandings In order to meet the standards, the students will need to understand that . . .	**Essential Questions** In order to understand, students will need to consider questions such as . . .	**Knowledge and Skills** Learning this material will require students to . . .	**Standards and Assessments**
Analyze proportional relationships and use them to solve real-world and mathematical problems. • Proportionality can be represented in many ways, including percents, ratios, and rates. It shows a relationship between two values, a part to a part or a part to a whole. • The relationship between a model and the actual object's dimensions is the scale, which is written as a ratio. • A circle graph represents data as proportional parts of a circle. • Rates are ratios of two quantities with different units. • You can use ratios to find equivalent rates and unit rates. • Unit rates are useful for comparisons. • Cross-products can be used to solve proportions. • A percent is a ratio with a denominator of 100. • You can write a percent as a decimal or as a fraction. • Finding the percent of change requires understanding the increase or decrease.	• How are constants of proportionality reflected in scale factor, slope and the graph of a linear equation? • What happens if the proportionality of a model is not maintained? • How does your understanding of ratios impact your effectiveness as a shopper? • Why are unit rates important for comparisons? • How do you solve a proportion with the cross products property? • How do you find the percent one number is of another number using a proportion? • Why is differentiating between part-to-part ratios and part-to-whole ratios critical for comparisons? • How are ratios and rates similar and different?	• Find ratios and unit rates • Find equivalent rates • Write and solve proportions • Solve percent problems using proportions • Rewrite and convert fractions, decimals, and percents • Order decimals, fractions, and percents • Solve percent problems with percent increase/decrease. • Solve percent problems using the percent equation • Understand and calculate discount, markup, tax, and simple interest • Add, subtract, multiply, and divide using fractions, decimals, or percents • Apply scale factor appropriately in different dimensions (length, area, volume) • Find the equation of a line from a graph, table, point and slope, or two points	• Chapter 4.8/7 (Scientific Notation, Metric Conversion and Ratios/Proportions/ Percents) Test **7.RP.1, 7.RP.2.a, 7.RP.2b, 7.RP.2c, 7.RP.3, 7.NS.2d** • Chapter 11 (Linear Equations and Graphs) Quest**7.EE.4a, 7.RP.2d, 8.F.1, 8.F.3, 8.F.4**

Geometry

Enduring Understandings In order to meet the standards, the students will need to understand that . . .	**Essential Questions** In order to understand, students will need to consider questions such as . . .	**Knowledge and Skills** Learning this material will require students to . . .	**Standards and Assessment**
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.** • The coordinate plane can be used to rotate, reflect and translate polygons. • Angle and side measurements are used in classifying shapes. • Certain combinations of angles and sides are necessary for creating polygons. • The Pythagorean Theorem is a tool for analyzing triangles. • Relationships exist in triangles that simplify solving for similarity. • Solids can be classified by the number of bases, faces, vertices, and edges. • Various aspects of geometric figures can be measured and calculated using algebra. • Formulas for calculating key aspects of geometric figures can be developed by using existing knowledge of the shapes.	• In geometry why is the concept of classifying important to giving the best answer? • How can you indirectly measure a distance? • How can you calculate angle measures in polygons? • How is the area of a parallelogram or a triangle related to the area of a rectangle? • What is the impact of an object's scale factor on the volume of similar figures? • How are the surface areas of prisms and cylinders similar and different? • Why are surface area and volume not always proportional? • What constraints must you consider when constructing a triangle? • Why is pi always an approximation? • Why is the concept of a "converse" important for the Pythagorean Theorem? • Why is it important to use an appropriate symbol for naming	• Understand complementary, supplementary, vertical and adjacent angles • Classify polygons and three-dimensional figures • Solve equations to find angle measures • Reflect, translate, and rotate figures in a coordinate plane • Apply the Pythagorean Theorem to solve problems involving right triangles • Analyze figures to determine similarity • Apply their understanding of similarity to geometry figures, solving for unknown sides and evaluating the scale factor • Understand if a combination of side lengths or angles can form a triangle • Determine two-dimensional figures resulting from slicing three-dimensional figures • Calculate circumference and area of a circle • Calculate the area of	• Chapter 3/6.4 (Solving Equations) Test **7.G.4** • Chapter 4.8/7 (Scientific Notation, Metric Conversion and Ratios/Proportions/Percents) Test **7.RP.1, 7.RP.2.a, 7.RP.2b, 7.RP.2c, 7.RP.3, 7.NS.2d, 7.G.1** • Chapter 8 (Polygons and Transformations) Test **7.G.1, 7.G.2, 7.G.5, 8.G.1a, 8.G.1b, 8.G.1c, 8.G.2, 8.G.3, 8.G.4, 8.G.5, 8.EE.5** • Chapter 9 (Real Numbers and Pythagorean Theorem) Test

Enduring Understandings In order to meet the standards, the students will need to understand that . . .	**Essential Questions** In order to understand, students will need to consider questions such as . . .	**Knowledge and Skills** Learning this material will require students to . . .	**Standards and Assessment**
	and notating points, lines, segments, rays and angles?	parallelograms and trapezoids • Calculate the surface area and volume of Prisms, Cylinders, Pyramids, Cones and Spheres	**7.NS.2b, 7.G.6, 8.G.6, 8.G.7, 8.NS.1, 8.NS.2** • Chapter 10 (Area, Surface Area, and Volume) Test**7.G.3, 7.G.4 7.G.MA.7, 8.G.9**

Statistics and Probability

Enduring Understandings In order to meet the standards, the students will need to understand that . . .	**Essential Questions** In order to understand, students will need to consider questions such as . . .	**Knowledge and Skills** Learning this material will require students to . . .	**Standards and Assessments**
Use random sampling to draw inferences about a population. **Draw informal comparative inferences about two populations.** • All data and statistics are biased. Data can be biased by many different elements, including questions and sampling methods. Bias comes from many different sources, and is inherent in human work. • Populations can be represented by samples. • Some ways of representing data are more effective than others for different data and/or results. **Investigate chance processes and develop, use, and evaluate probability models.** • The probability of an event occurring can often be determined mathematically. • Actual outcomes may not match mathematically predicted outcomes. • Counting and probability can be used to solve many real world problems.	• What is the best and most useful strategy for solving probability problems? • Why does the world not conform to probability all of the time? • What does it mean for a game to be fair? • How does the relationship between two or more events affect the probability of their outcomes?	• Count outcomes using an organized list • Determine probability using tree diagrams • Determine probability using an area model • Determine favorable outcomes of an event. • Use the counting principle • Represent probability as a fraction, decimal, or percent. • Understand permutations and combinations • Analyze situations involving independent and dependent events using many tools, including area models, counting trees, and multiplication. • Explain the connections between different methods of solving probability problems. • Express both theoretical and experimental probability. • Simulate a probability situation. • Determine the expected value of a chance situation. • Analyze games to determine if they are fair.	• Chapter 12 (Probability) Test **7.SP.1,7.SP.2, 7.SP.3, 7.SP.4, 7.SP.5, 7.SP.6, 7.SP.7.a, 7.SP.7.b**

Enduring Understandings In order to meet the standards, the students will need to understand that . . .	**Essential Questions** In order to understand, students will need to consider questions such as . . .	**Knowledge and Skills** Learning this material will require students to . . .	**Standards and Assessments**
• Probability explains how things will tend to act over many trials. • An expected value for a situation represents the average result. • Events can be dependent or independent of each other. Some will only happen if another happens first. Some may happen anyway. • Probability can be represented in many ways. • Not all games are fair.		• Solve for the probability of a compound event.	

Expressions and Equations

Enduring Understandings In order to meet the standards, the students will need to understand that . . .	**Essential Questions** In order to understand, students will need to consider questions such as . . .	**Knowledge and Skills** Learning this material will require students to . . .	**Standards and Assessments**
Use properties of operations to generate equivalent expressions. **Solve real-life and mathematical problems using numerical and algebraic expressions and equations.** • Patterns can come in a model that creates a line on a graph. • In order to evaluate numerical expressions, you must use order of operations. • Many different real-world situations can be represented using linear models. • Lines have specific properties that relate to information about the situation represented. • Variables represent unknown numbers that can be solved for, with sufficient information. • A function expresses a relationship between an input and it's only output. Lines are an example of functions. • Functions can be manipulated much like other algebraic equations – by replacing a representation of a value with the value.	• How is math a language? • Why are variables necessary? • What is a reasonable answer? • How do you represent numbers and their relationships to each other? • How are variables and constants in equations reflected in real life problems? • How is order of operations like the instruction manual for math? • How can a problem be solved with an equation, a graph and in a table? • What does it mean when a graph of a real world situation is a line? • How do lines on a coordinate plane convey information? • How does the concept of equivalent equations guide the process of solving equations? • How are distance, rate and time related? • How does the graph of an inequality differ from the graph of an equation? • How are the limits of an inequality expressed? • Why should you check a solution?	• Apply PEMDAS to evaluate numerical expressions • Write and evaluate variable expressions • Evaluate expressions with powers • Use formulas to find unknown values • Use a problem solving plan to solve problems • Solve equations using addition, subtraction, multiplication, and division • Solve two-step equations • Solve and graph linear inequalities. • Find the equation of a line from a graph, table, point and slope, or two points. • Analyze lines to solve real world problems.	• Chapter 1 (Variable and Equations) Test **7.EE.2, 7.EE.4a, 7.EE.4.MA.4.c, 8.EE.1** • Chapter 2 (Integers) Test **7.EE.1, 7.EE.2, 7.EE.3**, **7.EE.4a, 7.NS.1a, 7.NS.1b, 7.NS.1c 7.NS.1d, 7.NS.2a, 7.NS.2b, 7.NS.2c, 7.NS.2d, 7.NS.3** • Chapter 3/6.4 (Solving Equations) Test **7.G.4, 7.EE.4b, 8.EE.7a, 8.EE.7b** • Chapter 11 (Linear Equations and Graphs) Quest **7.EE.4a, 7.RP.2d, 8.F.1, 8.F.3, 8.F.4**

Enduring Understandings In order to meet the standards, the students will need to understand that . . .	**Essential Questions** In order to understand, students will need to consider questions such as . . .	**Knowledge and Skills** Learning this material will require students to . . .	**Standards and Assessments**
	• Why is it possible to solve an equation in different ways? • Why does an equation with two variables have an infinite number of solutions?	• Manipulate variables in multi-step equations to solve for a given variable. • Graph linear equations using intercepts. • Write functions in Slope-Intercept form. • Graph linear inequalities	• Chapters 6 & 11 (Multi-Step Equations and Linear Equations with Graphing) Test **7.EE.4a, 8.EE.6, 8.EE.7a, 8.F.3**