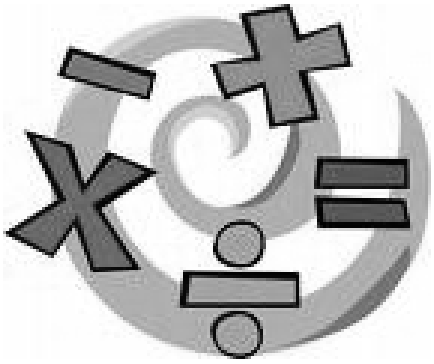
Milltown Public Schools
Milltown, NJ 08850

BASED ON NJ STUDENT LEARNING STANDARDS 2016

Mathematics Curriculum



Middle School Mathematics
Sixth through Eighth Grade

Adoption Date: November 27, 2017

Milltown Public Schools
Milltown, NJ 08850

MATHEMATICS CURRICULUM
Grades 6-8

Board of Education

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Foreword

Humankind is developing in an increasingly technological environment. With the greatest of rapidity, we can retrieve enormous amounts of data. Communication is becoming more accelerated as the Earth continues to shrink. People, out of necessity, are compelled to interact more as one than as different societies.

Education today requires a cadre of highly skilled teachers to bring forward to the minds of the children entrusted to their care the very best that there is to offer. The role of the classroom teacher can only be successful with the support of a Board of Education committed to excellence and parents and guardians who are knowledgeable and supportive of the individual needs of their own children. Teaching is best accomplished when the home, school, and community respond in this positive way.

A well-developed curriculum is one of the most fundamental ingredients for every child's educational success. It is the curriculum that melds into one the most current educational trends, the philosophy of education of the school district, and the desires of each and every parent and guardian to have his or her child reach the optimum of success. Education is global and addresses current as well as past events, offering students opportunities to make real world connections across every curricular area. In preparing our students for the 21st century, we must provide classroom instruction that prepares them with the skills necessary to access and connect information in a rapidly changing world.

There will be a continuing need to reach across the subject areas if we are to develop the child into a wholly educated individual. The skills of reading must be taught and reinforced in every subject, as must those of writing and mathematics. For the present time, and for the reasonably foreseeable future, these three fundamental areas will continue to be the core of the strength of the American society. Collectively they open the doors to all learning. In order for one to understand the laws of the nation, to make a contribution to society, and to value one's self and the rest of humankind, it is essential that this cross-curricular approach be embraced with enthusiasm.

This curriculum guide seeks to foster these ideals, so that the children of Milltown will be as well prepared as those from any other educational system. This guide emphasizes decision-making and citizenship skills and the need to conceptualize, rather than to learn by rote.

The educators of this district and the community are encouraged to utilize this guide as a vehicle to help assure that in Milltown we have indeed fulfilled our obligation to create a better world. A world in which there is more understanding for what is the common good of its entire people. A world in which our children will be better communicators and fully able to interact more as one, than as different societies.

Affirmative Action Statement

It is the policy of the Board of Education to provide equal employment and educational opportunities, regardless of race, color, creed, religion, sex, ancestry, national origin, place of residence, social or economic condition, or non-applicable handicap.

Affirmative Action Officer:

Norma Tursi, Business Administrator
Milltown Board of Education
21 West Church Street
Milltown, New Jersey 08850
(732) 214-2365

Adaptation for Special Education Statement

Although this curriculum guide has been developed for general education delivery, the knowledge, skills, attitudes, and behaviors identified are appropriate for the special education pupils in Milltown. Modifications necessary to accommodate the educational needs of an individual pupil's disability will be described in the Individualized Educational Program (IEP). They are on file at:

Office of Student Support Services
c/o Joyce Kilmer School
21 West Church Street
Milltown, NJ 08850
(732) 214-2365

Philosophy of Education

(Board Policy File # 6010)

The Milltown Board of Education accepts the responsibility for coordinating the available resources for home, school, and community in a mutual effort to guide every pupil's growth towards becoming a self-respecting individual who can effectively function politically, economically, and socially in a democratic society.

The Board believes New Jersey State goals should be applicable for every pupil in the Milltown School District to the limit to which the Board possesses jurisdiction, financial and staff resources.

A. All children should start school ready to learn.
   1. Quality preschool opportunities shall be provided for all specially eligible children, through collaboration between public schools and community agencies.
   2. Within financial and staff resources parent education programs shall be designed and implemented by the District to assist parents in providing readiness experiences for their preschool children.

B. The high school graduation rate shall be at least 90 percent (the receiving high school district shall be encouraged to embrace and implement these goals).
   1. The District shall provide least restrictive, alternative programs for pupils who cannot succeed in the regular high school environment, including those students with disabilities.
   2. The District shall provide dropout prevention programs for pupils at risk.

C. Pupils shall leave grades four, eight and eleven having demonstrated competency in challenging subject matter including Language Arts/ literacy, mathematics, science, and social studies (civics, history and geography), health, physical education, visual and performing arts and world languages.
   1. The District shall implement state-approved curriculum content standards and appropriate assessments to enable pupils to succeed and to evaluate their performance.
   2. The District shall provide staff development opportunities to ensure that teachers are adequately equipped to teach challenging and up-to-date subject matter and to implement effective teaching techniques.

D. Pupils shall learn to use their minds well, so that they may be prepared for responsible citizenship, further learning, and productive employment in our modern economy.
   1. The District shall provide students with experiences in higher-level thinking, information processing, the responsibilities of citizenship, and employability skills.
   2. All pupils shall demonstrate competency in the skills identified in the cross-content workplace readiness standards.
   3. All pupils shall demonstrate respect for racial, cultural, ethnic and religious diversity.

E. All pupils shall increase their achievement levels in science and mathematics to contribute to our country's ability to compete academically with other countries of the world.
   1. The District shall revise its curriculum offerings in science and mathematics according to state standards as they are developed.

2. The District shall provide staff training in the teaching of mathematics and science at grades K-8 to increase teachers' understanding of and ability to teach these subjects.

F. Every adult shall be literate and possess the knowledge and skills necessary to compete in a global economy and exercise the rights and responsibilities of citizenship.
   1. Adult education programs shall be increased in conjunction with other local districts, community colleges and other educational agencies, to provide greater opportunities for adults to continue learning for work skills, leisure pursuits, intellectual and cultural growth and to assist their children in learning.
   2. Business and industry shall be encouraged to collaborate with educational agencies to design and increase access to educational programs for adults, such as flex time, distance learning and interactive technology.

G. District schools shall be free of drugs and violence and offer a safe, disciplined environment conducive to learning.
   1. The District shall develop partnerships with parents to establish the responsibilities of each to create and maintain safe and healthy educational environments for all pupils.
   2. The District shall provide programs and staffing to deal with pupils at risk.
   3. The school and community shall expand their cooperative efforts to create drug and violence-free environments.
   4. All students shall develop a positive view of self and learn to use effective interpersonal skills.

The Board shall develop, in consultation with the chief school administrator and teaching staff members, a written educational plan for the District. This plan shall be reviewed and adopted annually and shall include:

A. Written educational goals;
B. An assessment of pupil needs;
C. Specific annual objectives based on identified needs and action plans to implement them;
D. Standards for assessing and evaluating the achievement of objectives;
E. The establishment of reasonable pupil minimum proficiency levels in the areas addressed in the core curriculum content standards;
F. An educational program consistent with these goals, objectives, standards and needs;
G. An evaluation of pupil progress.

Adopted: *September 23, 1997*
Revised: *March 29, 1999*
Revised: *May 27, 2008*

Table of Contents

SIXTH GRADE

Mathematics Emphasis in Grade 6

- Understand ratio concepts and use ratio reasoning to solve problems.
- Apply and extend previous understandings of multiplication and division to divide fractions by fractions.
- Apply and extend previous understandings of numbers to the system of rational numbers.
- Apply and extend previous understandings of arithmetic to algebraic expressions.
- Reason about and solve one-variable equations and inequalities.
- Represent and analyze quantitative relationships between dependent and independent variables.

PARCC Grade Level Fluency Expectations

1. Apply and extend previous understandings of multiplication and division to divide fractions by fractions.
   The Number System: 6.NS.1

2. Compute fluently with multi-digit numbers and find common factors and multiples.
   The Number System: 6.NS.2-3

Major Within Grade Dependencies

- Equations of the form px = q (6.EE.7) are unknown-factor problems; the solution will sometimes be the quotient of a fraction by a fraction (6.NS.1).
- Solving problems by writing and solving equations (6.EE.7) involves not only an appreciation of how variables are used (6.EE.6) and what it means to solve an equation (6.EE.5) but also some ability to write, read, and evaluate expressions in which letters stand for numbers (6.EE.2).
- Students must be able to place rational numbers on a number line (6.NS.7) before they can place ordered pairs of rational numbers on a coordinate plane (6.NS.8). The former standard about ordering rational numbers is much more fundamental.

OPERATIONS AND PROPERTIES

How do you use properties to find equivalent expressions?

Chapter 1 MP 1 Weeks 2-5

BIG IDEAS

- Compute fluently with multi-digit numbers and find common factors and multiples.
- Apply and extend previous understandings of arithmetic to algebraic expressions.

ENDURING UNDERSTANDINGS

The Number System

6.NS.2 Fluently divide multi-digit numbers using the standard algorithm

6.NS.4 Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the distributive property to express a sum of two whole numbers 1–100 with a common factor as a multiple of a sum of two whole numbers with no common factor. For example, express 36 + 8 as 4 (9 + 2).

Expressions and Equations

6.EE.1 [M] Write and evaluate numerical expressions involving whole-number exponents.

6.EE.2c Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). For example, use the formulas $V = s^3$ and $A = 6\ s^2$ to find the volume and surface area of a cube with sides of length $s = 1/2$.

6.EE.3 Apply the properties of operations to generate equivalent expressions. For example, apply the distributive property to the expression 3 (2 + x) to produce the equivalent expression 6 + 3x; apply the distributive property to the expression 24x + 18y to produce the equivalent expression 6 (4x + 3y); apply properties of operations to y + y + y to produce the equivalent expression 3y.

INTRODUCTION TO ALGEBRA

How do you evaluate expressions?

Chapter 2 MP 1 Weeks 5-8

BIG IDEAS

- Apply and extend previous understandings of arithmetic to algebraic expressions.
- Reason about and solve one-variable equations and inequalities.

ENDURING UNDERSTANDINGS

Expressions and Equations

6.EE.2 [M] Write, read, and evaluate expressions in which letters stand for numbers.

6.EE.2a [M] Write expressions that record operations with numbers and with letters standing for numbers. For example, express the calculation "Subtract y from 5" as 5 – y.

6.EE.2b Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, and coefficient); view one or more parts of an expression as a single entity. For example, describe the expression 2 (8 + 7) as a product of two factors; view (8 + 7) as both a single entity and a sum of two terms.

6.EE.3 Apply the properties of operations to generate equivalent expressions. For example, apply the distributive property to the expression 3 (2 + x) to produce the equivalent expression 6 + 3x; apply the distributive property to the expression 24x + 18y to produce the equivalent expression 6 (4x + 3y); apply properties of operations to y + y + y to produce the equivalent expression 3y.

6.EE.4 Identify when two expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them). For example, the expressions y + y + y and 3y are equivalent because they name the same number regardless of which number y stands for.

6.EE.5 [M] Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.

6.EE.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.

6.EE.7 Solve real-world and mathematical problems by writing and solving equations of the form x + p = q and px = q for cases in which p, q and x are all nonnegative rational numbers.

DECIMALS

What are common procedures to multiply and divide decimals?

Chapter 3 MP 2 Weeks 1-4

BIG IDEAS

- Compute fluently with multi-digit numbers and find common factors and multiples.
- Reason about and solve one-variable equations and inequalities.

ENDURING UNDERSTANDINGS

The Number System

6.NS.3 Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.

Expressions and Equations

6.EE.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.

6.EE.7 Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p, q and x are all nonnegative rational numbers.

NUMBER THEORY AND FRACTIONS

How do you use multiplication and division to determine equivalent fractions?

Chapter 4 MP 2 Weeks 4-6

BIG IDEAS

- Compute fluently with multi-digit numbers and find common factors and multiples.
- Apply and extend previous understandings of numbers to the system of rational numbers.
- Apply and extend previous understandings of arithmetic to algebraic expressions.

ENDURING UNDERSTANDINGS

The Number System

6.NS.4 Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the distributive property to express a sum of two whole numbers 1–100 with a common factor as a multiple of a sum of two whole numbers with no common factor. For example, express 36 + 8 as 4 (9 + 2).

6.NS.7 [M] Understand ordering and absolute value of rational numbers.

Expressions and Equations

6.EE.2b [M] Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, and coefficient); view one or more parts of an expression as a single entity. For example, describe the expression 2 (8 + 7) as a product of two factors; view (8 + 7) as both a single entity and a sum of two terms.

6.EE.3 [M] Apply the properties of operations to generate equivalent expressions. For example, apply the distributive property to the expression 3 (2 + x) to produce the equivalent expression 6 + 3x; apply the distributive property to the expression 24x + 18y to produce the equivalent expression 6 (4x + 3y); apply properties of operations to y + y + y to produce the equivalent expression 3y.

6.EE.4 [M] Identify when two expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them). For example, the expressions y + y + y and 3y are equivalent because they name the same number regardless of which number y stands for.

FRACTION OPERATIONS

How do you evaluate expressions and solve equations with fractions?

Chapter 5 MP 2 Weeks 7-9

BIG IDEAS

- Apply and extend previous understandings of multiplication and division to divide fractions by fractions.
- Compute fluently with multi-digit numbers and find common factors and multiples.
- Reason about and solve one-variable equations and inequalities.

ENDURING UNDERSTANDINGS

The Number System

6.NS.1 [M] Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. For example, create a story context for (2/3) ÷ (3/4) and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that (2/3) ÷ (3/4) = 8/9 because 3/4 of 8/9 is 2/3. (In general, (a/b) ÷ (c/d) = ad/bc.) How much chocolate will each person get if 3 people share 1/2 lb of chocolate equally? How many 3/4-cup servings are in 2/3 of a cup of yogurt? How wide is a rectangular strip of land with length 3/4 mi and area 1/2 square mi?

6.NS.4 Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the distributive property to express a sum of two whole numbers 1–100 with a common factor as a multiple of a sum of two whole numbers with no common factor. For example, express 36 + 8 as 4 (9 + 2).

Expressions and Equations

6.EE.6 [M] Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.

6.EE.7 [M] Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p, q and x are all nonnegative rational numbers.

DATA COLLECTION AND ANALYSIS

What methods can be used to summarize data?

Chapter 6 MP 3 Weeks 8-10

BIG IDEAS

- Apply and extend previous understandings of numbers to the system of rational numbers.
- Develop understanding of statistical variability.
- Summarize and describe distributions.

ENDURING UNDERSTANDINGS

Career Education Integration

9.2.8.B.4 Evaluate how traditional and nontraditional careers have evolved regionally, nationally, and globally.

9.2.8.B.5 Analyze labor market trends using state and federal labor market information and other resources available online.

Connection: An end-of-the-year culminating benchmark assessment is assigned. A compilation of the NJSLS are used throughout the project and are based on the career the student chooses. Students are required to choose a career and they utilize their research skills to investigate how the career uses mathematics on a daily basis. Two full essays are required which pertain to how their chosen career uses math as well as how their career benefits society as a whole.

The Number System

6.NS.7c Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation. For example, for an account balance of –30 dollars, write |–30| = 30 to describe the size of the debt in dollars.

6.NS.7d Distinguish comparisons of absolute value from statements about order. For example, recognize that an account balance less than –30 dollars represents a debt greater than 30 dollars.

Statistics and Probability

6.SP.1 Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers. For example, "How old am I?" is not a statistical question, but "How old are the students in my school?" is a statistical question because one anticipates variability in students' ages.

6.SP.2 Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.

6.SP.3 Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number.

6.SP.4 Display numerical data in plots on a number line, including dot plots, histograms, and box plots.

6.SP.5 Summarize numerical data sets in relation to their context, such as by:

6.SP.5a Reporting the number of observations.

6.SP.5b Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.

6.SP.5c Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.

6.SP.5d Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.

PROPORTIONAL RELATIONSHIPS

How can proportional reasoning help to solve rate and ratio problems?

Chapter 7 MP 3 Weeks 1-5

BIG IDEAS

- Understand ratio concepts and use ratio reasoning to solve problems.
- Apply and extend previous understandings of numbers to the system of rational numbers.
- Analyze proportional relationships and use them to solve real-world and mathematical problems (Slope).

ENDURING UNDERSTANDINGS

The Number System

6.NS.6 Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates.

6.NS.6c Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane.

Ratios and Proportional Relationships

6.RP.1 [M] Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. For example, "The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak." "For every vote candidate A received, candidate C received nearly three votes."

6.RP.2 [M] Understand the concept of a unit rate a/b associated with a ratio a:b with $b \neq 0$, and use rate language in the context of a ratio relationship. For example, "This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is 3/4 cup of flour for each cup of sugar." "We paid $75 for 15 hamburgers, which is a rate of $5 per hamburger."

6.RP.3 [M] Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.

6.RP.3a [M] Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.

6.RP.3b [M] Solve unit rate problems including those involving unit pricing and constant speed. For example, if it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?

6.RP.3c [M] Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent.

7.RP.1 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.

7.RP.2 Recognize and represent proportional relationships between quantities.

7.RP.2a 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.

7.RP.2b Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.

7.RP.2c 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.

7.RP.2d 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.

7.RP.3 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.

MEASUREMENT AND GEOMETRY

How do you solve problems that involve lengths, areas, and volumes?

Chapter 8 MP 3 Weeks 5-7

BIG IDEAS

- Understand ratio concepts and use ratio reasoning to solve problems.
- Apply and extend previous understandings of arithmetic to algebraic expressions.
- Solve real-world and mathematical problems involving area, surface area, and volume.

ENDURING UNDERSTANDINGS

Ratios and Proportional Relationships

6.RP.3d [M] Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.

Expressions and Equations

6.EE.2c [M] Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). For example, use the formulas $V = s^3$ and $A = 6\ s^2$ to find the volume and surface area of a cube with sides of length $s = 1/2$.

Geometry

6.G.1 Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.

6.G.2 Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas $V = l\ w\ h$ and $V = B\ h$ to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.

6.G.4 Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.

INTEGERS AND COORDINATE PLANE

How do you graph and locate ordered pairs on four quadrants of a coordinate plane?

Chapter 9 MP 1 Weeks 8-10

BIG IDEAS

- Apply and extend previous understandings of numbers to the system of rational numbers.
- Solve real-world and mathematical problems involving area, surface area, and volume.
- Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.

ENDURING UNDERSTANDINGS

The Number System

6.NS.5 [M] Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.

6.NS.6 [M] Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates.

6.NS.6a [M] Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself, e.g., –(–3) = 3, and that 0 is its own opposite.

6.NS.6b [M] Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes.

6.NS.6c [M] Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane.

6.NS.7 Understand ordering and absolute value of rational numbers.

6.NS.7a [M] Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram. For example, interpret –3 > –7 as a statement that –3 is located to the right of –7 on a number line oriented from left to right.

6.NS.7b [M] Write, interpret, and explain statements of order for rational numbers in real-world contexts. For example, write –3 ^{o}C > –7 ^{o}C to express the fact that –3 ^{o}C is warmer than –7 ^{o}C.

6.NS.7c [M] Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation. For example, for an account balance of –30 dollars, write |–30| = 30 to describe the size of the debt in dollars.

6.NS.7d [M] Distinguish comparisons of absolute value from statements about order. For example, recognize that an account balance less than –30 dollars represents a debt greater than 30 dollars.

6.NS.8 [M] Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.

7.NS.1 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.

7.NS.1a 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.

7.NS.1b 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.

7.NS.1c 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 their difference, and apply this principle in real-world contexts.

7.NS.2 Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.

7.NS.2a 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.

7.NS.2b 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.

7.NS.2c Apply properties of operations as strategies to multiply and divide rational numbers.

7.NS.3 Solve real-world and mathematical problems involving the four operations with rational numbers

Geometry

6.G.3 Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques in the context of solving real-world and mathematical problems.

8.G.1 Verify experimentally the properties of rotations, reflections, and translations.

FUNCTIONS

How can you use mathematics to describe an observable event?

Chapter 10 MP 4 Weeks 1-3

BIG IDEAS

- Understand ratio concepts and use ratio reasoning to solve problems.
- Apply and extend previous understandings of arithmetic to algebraic expressions.
- Reason about and solve one-variable equations and inequalities.
- Represent and analyze quantitative relationships between dependent and independent variables.
- Solve real-world and mathematical problems involving area, surface area, and volume.

ENDURING UNDERSTANDINGS

Ratios and Proportional Relationships

6.RP.3 Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.

Expressions and Equations

6.EE.2c Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). For example, use the formulas $V = s^3$ and $A = 6 s^2$ to find the volume and surface area of a cube with sides of length $s = 1/2$.

6.EE.8 [M] Write an inequality of the form $x > c$ or $x < c$ to represent a constraint or condition in a real-world or mathematical problem. Recognize that inequalities of the form $x > c$ or $x < c$ have infinitely many solutions; represent solutions of such inequalities on number line diagrams.

6.EE.9 [M] Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation.

Geometry

6.G.1 Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.

PRE-ALGEBRA PREREQUISITES

What skills and concepts are important for pre-algebra?

BIG IDEAS

- Use properties of operations to generate equivalent expressions.
- Use random sampling to draw inferences about a population.
- Investigate chance processes and develop, use, and evaluate probability models.

ENDURING UNDERSTANDINGS

Expressions and Equations

6.EE.2c Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.

Statistics and Probability

7.SP.1 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 tends to produce representative samples and support valid inferences.

7.SP.5 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.

7.SP.6 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.

SIXTH GRADE
HONORS

Mathematics Emphasis in Grade 6 Honors

- Understand ratio concepts and use ratio reasoning to solve problems.
- Apply and extend previous understandings of multiplication and division to divide fractions by fractions.
- Apply and extend previous understandings of numbers to the system of rational numbers.
- Apply and extend previous understandings of arithmetic to algebraic expressions.
- Reason about and solve one-variable equations and inequalities.
- Represent and analyze quantitative relationships between dependent and independent variables.
- This course is made up of two textbooks Holt 6 & Holt 7

PARCC Grade Level Fluency Expectations

1. Apply and extend previous understandings of multiplication and division to divide fractions by fractions.
   The Number System: 6.NS.1

2. Compute fluently with multi-digit numbers and find common factors and multiples.
   The Number System: 6.NS.2-3

Major Within Grade Dependencies

- Equations of the form px = q (6.EE.7) are unknown-factor problems; the solution will sometimes be the quotient of a fraction by a fraction (6.NS.1).
- Solving problems by writing and solving equations (6.EE.7) involves not only an appreciation of how variables are used (6.EE.6) and what it means to solve an equation (6.EE.5) but also some ability to write, read, and evaluate expressions in which letters stand for numbers (6.EE.2).
- Students must be able to place rational numbers on a number line (6.NS.7) before they can place ordered pairs of rational numbers on a coordinate plane (6.NS.8). The former standard about ordering rational numbers is much more fundamental.

OPERATIONS AND PROPERTIES

How do you use properties to find equivalent expressions?

Chapter 1 MP 1 Weeks 2-3

BIG IDEAS

- Compute fluently with multi-digit numbers and find common factors and multiples.
- Apply and extend previous understandings of arithmetic to algebraic expressions.

ENDURING UNDERSTANDINGS

The Number System

6.NS.2 Fluently divide multi-digit numbers using the standard algorithm

6.NS.4 Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the distributive property to express a sum of two whole numbers 1–100 with a common factor as a multiple of a sum of two whole numbers with no common factor. For example, express 36 + 8 as 4 (9 + 2).

7.NS.1d [M] Apply properties of operations as strategies to add and subtract rational numbers.

Expressions and Equations

6.EE.1 [M] Write and evaluate numerical expressions involving whole-number exponents.

6.EE.2c Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). For example, use the formulas $V = s^3$ and $A = 6 s^2$ to find the volume and surface area of a cube with sides of length $s = 1/2$.

6.EE.3 Apply the properties of operations to generate equivalent expressions. For example, apply the distributive property to the expression 3 (2 + x) to produce the equivalent expression 6 + 3x; apply the distributive property to the expression 24x + 18y to produce the equivalent expression 6 (4x + 3y); apply properties of operations to y + y + y to produce the equivalent expression 3y.

7.EE.1 [M] Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.

7.EE.2 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."

7.EE.3 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.

INTRODUCTION TO ALGEBRA

How do you evaluate expressions?

Chapter 2 MP 1 Weeks 4-6

BIG IDEAS

- Apply and extend previous understandings of arithmetic to algebraic expressions.
- Reason about and solve one-variable equations and inequalities.

ENDURING UNDERSTANDINGS

The Number System

7.NS.1	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.
7.NS.1a [M]	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.
7.NS.1b	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.
7.NS.1c	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 their difference, and apply this principle in real-world contexts.
7.NS.2	Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.
7.NS.2a	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.
7.NS.2b	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.
7.NS.2c [M]	Apply properties of operations as strategies to multiply and divide rational numbers.
7.NS.3	Solve real-world and mathematical problems involving the four operations with rational numbers.

Expressions and Equations

6.EE.2 [M]	Write, read, and evaluate expressions in which letters stand for numbers.
6.EE.2a [M]	Write expressions that record operations with numbers and with letters standing for numbers. For example, express the calculation "Subtract y from 5" as $5 – y$.
6.EE.2b	Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); view one or more parts of an expression as a single entity. For example, describe the expression $2 (8 + 7)$ as a product of two factors; view $(8 + 7)$ as both a single entity and a sum of two terms.
6.EE.3	Apply the properties of operations to generate equivalent expressions. For example, apply the distributive property to the expression $3 (2 + x)$ to produce the equivalent expression $6 + 3x$; apply the distributive property to the expression $24x + 18y$ to produce the equivalent expression $6 (4x + 3y)$; apply properties of operations to $y + y + y$ to produce the equivalent expression $3y$.
6.EE.4	Identify when two expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them). For example, the expressions $y + y + y$ and $3y$ are equivalent because they name the same number regardless of which number y stands for.

6.EE.5 [M] Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.

6.EE.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.

6.EE.7 Solve real-world and mathematical problems by writing and solving equations of the form x + p = q and px = q for cases in which p, q and x are all nonnegative rational numbers.

7.EE.4 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.

DECIMALS

What are common procedures to multiply and divide decimals?

Chapter 3 MP 1 Weeks 10-11

BIG IDEAS

- Compute fluently with multi-digit numbers and find common factors and multiples.
- Reason about and solve one-variable equations and inequalities.

ENDURING UNDERSTANDINGS

The Number System

6.NS.3 Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.

Expressions and Equations

6.EE.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.

6.EE.7 Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p, q and x are all nonnegative rational numbers.

NUMBER THEORY AND FRACTIONS

How do you use multiplication and division to determine equivalent fractions?

Chapter 4 MP 2 Weeks 3-4

BIG IDEAS

- Compute fluently with multi-digit numbers and find common factors and multiples.
- Apply and extend previous understandings of numbers to the system of rational numbers.
- Apply and extend previous understandings of arithmetic to algebraic expressions.

ENDURING UNDERSTANDINGS

The Number System

6.NS.4 Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the distributive property to express a sum of two whole numbers 1–100 with a common factor as a multiple of a sum of two whole numbers with no common factor. For example, express 36 + 8 as 4 (9 + 2).

6.NS.7 [M] Understand ordering and absolute value of rational numbers.

Expressions and Equations

6.EE.2b [M] Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); view one or more parts of an expression as a single entity. For example, describe the expression 2 (8 + 7) as a product of two factors; view (8 + 7) as both a single entity and a sum of two terms.

6.EE.3 [M] Apply the properties of operations to generate equivalent expressions. For example, apply the distributive property to the expression 3 (2 + x) to produce the equivalent expression 6 + 3x; apply the distributive property to the expression 24x + 18y to produce the equivalent expression 6 (4x + 3y); apply properties of operations to y + y + y to produce the equivalent expression 3y.

6.EE.4 [M] Identify when two expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them). For example, the expressions y + y + y and 3y are equivalent because they name the same number regardless of which number y stands for.

FRACTION OPERATIONS

How do you evaluate expressions and solve equations with fractions?

Chapter 5 MP 2 Weeks 5-6

BIG IDEAS

- Apply and extend previous understandings of multiplication and division to divide fractions by fractions.
- Compute fluently with multi-digit numbers and find common factors and multiples.
- Reason about and solve one-variable equations and inequalities.

ENDURING UNDERSTANDINGS

The Number System

6.NS.1 [M] Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. For example, create a story context for (2/3) ÷ (3/4) and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that (2/3) ÷ (3/4) = 8/9 because 3/4 of 8/9 is 2/3. (In general, (a/b) ÷ (c/d) = ad/bc.) How much chocolate will each person get if 3 people share 1/2 lb of chocolate equally? How many 3/4-cup servings are in 2/3 of a cup of yogurt? How wide is a rectangular strip of land with length 3/4 mi and area 1/2 square mi?

6.NS.4 Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the distributive property to express a sum of two whole numbers 1–100 with a common factor as a multiple of a sum of two whole numbers with no common factor. For example, express 36 + 8 as 4 (9 + 2).

Expressions and Equations

6.EE.6 [M] Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.

6.EE.7 [M] Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p, q and x are all nonnegative rational numbers.

DATA COLLECTION AND ANALYSIS

What methods can be used to summarize data?

Chapter 6 MP 3 Weeks 4-6

BIG IDEAS

- Apply and extend previous understandings of numbers to the system of rational numbers.
- Develop understanding of statistical variability.
- Summarize and describe distributions.

ENDURING UNDERSTANDINGS

Career Education Integration

9.2.8.B.4 Evaluate how traditional and nontraditional careers have evolved regionally, nationally, and globally.

9.2.8.B.5 Analyze labor market trends using state and federal labor market information and other resources available online.

Connection: An end-of-the-year culminating benchmark assessment is assigned. A compilation of the NJSLS are used throughout the project and are based on the career the student chooses. Students are required to choose a career and they utilize their research skills to investigate how the career uses mathematics on a daily basis. Two full essays are required which pertain to how their chosen career uses math as well as how their career benefits society as a whole.

The Number System

6.NS.7c Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation. For example, for an account balance of –30 dollars, write |–30| = 30 to describe the size of the debt in dollars.

6.NS.7d Distinguish comparisons of absolute value from statements about order. For example, recognize that an account balance less than –30 dollars represents a debt greater than 30 dollars.

Statistics and Probability

6.SP.1 Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers. For example, "How old am I?" is not a statistical question, but "How old are the students in my school?" is a statistical question because one anticipates variability in students' ages.

6.SP.2 Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.

6.SP.3 Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number.

6.SP.4 Display numerical data in plots on a number line, including dot plots, histograms, and box plots.

6.SP.5 Summarize numerical data sets in relation to their context, such as by:

6.SP.5a	Reporting the number of observations.
6.SP.5b	Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.
6.SP.5c	Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.
6.SP.5d	Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.

PROPORTIONAL RELATIONSHIPS

How can proportional reasoning help to solve rate and ratio problems?

Holt Grade 6 Chapter 7 MP 2 Weeks 8-9
Holt Grade 7 Chapter 4

BIG IDEAS

- Understand ratio concepts and use ratio reasoning to solve problems.
- Apply and extend previous understandings of numbers to the system of rational numbers.
- Analyze proportional relationships and use them to solve real-world and mathematical problems (Slope).

ENDURING UNDERSTANDINGS

The Number System

6.NS.6	Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates.
6.NS.6c	Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane.

Ratios and Proportional Relationships

6.RP.1 [M]	Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. For example, "The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak." "For every vote candidate A received, candidate C received nearly three votes."
6.RP.2 [M]	Understand the concept of a unit rate a/b associated with a ratio a:b with $b \neq 0$, and use rate language in the context of a ratio relationship. For example, "This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is 3/4 cup of flour for each cup of sugar." "We paid $75 for 15 hamburgers, which is a rate of $5 per hamburger."
6.RP.3 [M]	Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.
6.RP.3a [M]	Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.
6.RP.3b [M]	Solve unit rate problems including those involving unit pricing and constant speed. For example, if it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?
6.RP.3c [M]	Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent.

7.RP.1 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.

7.RP.2 Recognize and represent proportional relationships between quantities.

7.RP.2a 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.

7.RP.2b Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.

7.RP.2c 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.

7.RP.2d 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.

7.RP.3 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.

Geometry

7.G.1 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.

MEASUREMENT AND GEOMETRY

How do you solve problems that involve lengths, areas, and volumes?

Holt Grade 6 Chapter 8 MP 3 Weeks 1-3
Holt Grade 7 Chapter 9

BIG IDEAS

- Understand ratio concepts and use ratio reasoning to solve problems.
- Apply and extend previous understandings of arithmetic to algebraic expressions.
- Solve real-world and mathematical problems involving area, surface area, and volume.

ENDURING UNDERSTANDINGS

Ratios and Proportional Relationships

6.RP.3d [M] Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.

Expressions and Equations

6.EE.2c [M] Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). For example, use the formulas $V = s^3$ and $A = 6 s^2$ to find the volume and surface area of a cube with sides of length s = 1/2.

Geometry

6.G.1 Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.

6.G.2	Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas $V = l\ w\ h$ and $V = b\ h$ to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.
6.G.4	Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.
7.G.3	Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.
7.G.4	Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle.
7.G.6	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.

INTEGERS AND COORDINATE PLANE

How do you graph and locate ordered pairs on four quadrants of a coordinate plane?

Chapter 9 MP 1 Weeks 7-9

BIG IDEAS

- Apply and extend previous understandings of numbers to the system of rational numbers.
- Solve real-world and mathematical problems involving area, surface area, and volume.
- Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.

ENDURING UNDERSTANDINGS

The Number System

6.NS.5 [M]	Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.
6.NS.6 [M]	Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates.
6.NS.6a [M]	Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself, e.g., –(–3) = 3, and that 0 is its own opposite.
6.NS.6b [M]	Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes.
6.NS.6c[M]	Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane.
6.NS.7	Understand ordering and absolute value of rational numbers.
6.NS.7a [M]	Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram. For example, interpret –3 > –7 as a statement that –3 is located to the right of –7 on a number line oriented from left to right.

6.NS.7b [M]	Write, interpret, and explain statements of order for rational numbers in real-world contexts. For example, write $-3\ ^{o}C > -7\ ^{o}C$ to express the fact that $-3\ ^{o}C$ is warmer than $-7\ ^{o}C$.
6.NS.7c [M]	Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation. For example, for an account balance of –30 dollars, write |–30| = 30 to describe the size of the debt in dollars.
6.NS.7d [M]	Distinguish comparisons of absolute value from statements about order. For example, recognize that an account balance less than –30 dollars represents a debt greater than 30 dollars.
6.NS.8 [M]	Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.
7.NS.1	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.
7.NS.1a	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.
7.NS.1b	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.
7.NS.1c	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 their difference, and apply this principle in real-world contexts.
7.NS.2	Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.
7.NS.2a	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.
7.NS.2b.	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 realworld contexts.
7.NS.2c	Apply properties of operations as strategies to multiply and divide rational numbers.
7.NS.3	Solve real-world and mathematical problems involving the four operations with rational numbers

Geometry

6.G.3	Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques in the context of solving real-world and mathematical problems.
8.G.1	Verify experimentally the properties of rotations, reflections, and translations.

FUNCTIONS

How can you use mathematics to describe an observable event?

Chapter 10 MP 3 Weeks 7-8

BIG IDEAS

- Understand ratio concepts and use ratio reasoning to solve problems.
- Apply and extend previous understandings of arithmetic to algebraic expressions.
- Reason about and solve one-variable equations and inequalities.
- Represent and analyze quantitative relationships between dependent and independent variables.
- Solve real-world and mathematical problems involving area, surface area, and volume.

ENDURING UNDERSTANDINGS

Ratios and Proportional Relationships

6.RP.3 Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.

Expressions and Equations

6.EE.2c Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). For example, use the formulas $V = s^3$ and $A = 6\ s^2$ to find the volume and surface area of a cube with sides of length $s = 1/2$.

6.EE.8[M] Write an inequality of the form $x > c$ or $x < c$ to represent a constraint or condition in a real-world or mathematical problem. Recognize that inequalities of the form $x > c$ or $x < c$ have infinitely many solutions; represent solutions of such inequalities on number line diagrams.

6.EE.9[M] Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation.

Geometry

6.G.1 Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.

PRE-ALGEBRA PREREQUISITES

What skills and concepts are important for pre-algebra?

BIG IDEAS

- Use properties of operations to generate equivalent expressions.
- Use random sampling to draw inferences about a population.
- Investigate chance processes and develop, use, and evaluate probability models.

MATHEMATICS: Sixth Grade Honors

ENDURING UNDERSTANDINGS

Expressions and Equations

6.EE.2c Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.

Statistics and Probability

7.SP.1 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 tends to produce representative samples and support valid inferences.

7.SP.5 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.

7.SP.6 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.

SEVENTH GRADE
PRE-ALGEBRA

Mathematics Emphasis in Grade 7

- Analyze proportional relationships and use them to solve real-world and mathematical problems.
- Apply and extend previous understandings of operations with fractions to add, subtract, multiply and divide rational numbers.
- Use properties of operations to generate equivalent expressions.
- Solve real-life and mathematical problems using numerical and algebraic expressions and equations.
- This course is made up of two textbooks Holt 7 & Holt 8

PARCC Grade Level Fluency Expectations

1. Solve real-life and mathematical problems using numerical and algebraic expressions and equations.
   Expressions and Equations: 7.EE.3-4

2. Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.
   The Number System: 7.NS.1

Major Within Grade Dependencies

- Meeting standard 7.EE.3 in its entirety will involve using rational number arithmetic (7.NS.1-3) and percents (7.RP.3). Work leading to meeting this standard could be organized as a recurring activity that tracks the students' ongoing acquisition of new skills in rational number arithmetic and percents.
- Because rational number arithmetic (7.NS.1-3) underlies the problem solving detailed in 7.EE.3 as well as the solution of linear expressions and equations (7.EE.1-2, 4), this work should likely begin at or near the start of the year.
- The work leading to meeting standards 7.EE.1-4 could be divided into two phases, one centered on addition and subtraction (e.g., solving $x + q = r$) in relation to rational number addition and subtraction (7.NS.1) and another centered on multiplication and division (e.g., solving $px + q = r$ and $p(x + q) = r$) in relation to rational number multiplication and division (7.NS.2).

ALGEBRAIC REASONING

How do you apply properties of operations to solve equations?

Chapter 1 MP 1 Weeks 6-10

BIG IDEAS

- Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.
- Use properties of operations to generate equivalent expressions.
- Solve real-life and mathematical problems using numerical and algebraic expressions and equations.

ENDURING UNDERSTANDINGS

The Number System

7.NS.1d [M] Apply properties of operations as strategies to add and subtract rational numbers.

Expressions and Equations

7.EE.1 [M] Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.

7.EE.2 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."

7.EE.3 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.

7.EE.4 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.

INTEGERS AND RATIONAL NUMBERS

How do you apply properties of operations when solving equations with integers?

Chapter 2 MP 1 Weeks 2-5

BIG IDEAS

- Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.
- Solve real-life and mathematical problems using numerical and algebraic expressions and equations.

ENDURING UNDERSTANDINGS

The Number System

7.NS.1 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.

7.NS.1a [M] Describe situations in which opposite quantities combine to make 0. For example, in the first round of a game, Maria scored 20 points. In the second round of the same game, she lost 20 points. What is her score at the end of the second round?

7.NS.1b 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.

7.NS.1c 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 their difference, and apply this principle in real-world contexts.

7.NS.2 Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.

7.NS.2a 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.

7.NS.2b 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.

7.NS.2c [M] Apply properties of operations as strategies to multiply and divide rational numbers.

7.NS.3 Solve real-world and mathematical problems involving the four operations with rational numbers.

Expressions and Equations

7.EE.4 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.

APPLYING RATIONAL NUMBERS

How do solve equations involving decimals and fractions?

Chapter 3

MP 1 Weeks 10-11
MP 2 Weeks 1-4

BIG IDEAS

- Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.
- Solve real-life and mathematical problems using numerical and algebraic expressions and equations.

ENDURING UNDERSTANDINGS

The Number System

7.NS.1 [M] 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.

7.NS.1b [M] 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.

7.NS.1c [M] 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 their difference, and apply this principle in real-world contexts.

7.NS.2 [M] Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.

7.NS.2a [M] 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.

7.NS.2b [M] 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.

7.NS.3 [M] Solve real-world and mathematical problems involving the four operations with rational numbers.

Expressions and Equations

7.EE.4 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.

PROPORTIONAL RELATIONSHIPS

How do you use proportionality to solve problems?

Holt Grade 7	Chapter 4	MP 3 Weeks 8-10
Holt Grade 8	Chapter 5	MP 3 Weeks 8-10

BIG IDEAS

- Analyze proportional relationships and use them to solve real-world and mathematical problems.
- Draw, construct, and describe geometrical figures and describe the relationships between them.
- Understand congruence and similarity using physical models, transparencies, or geometry software.

ENDURING UNDERSTANDINGS

Ratios and Proportional Relationships

7.RP.1 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.

7.RP.2 Recognize and represent proportional relationships between quantities.

7.RP.2a 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.

7.RP.2b Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.

7.RP.2c 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 $t = pn$.

Geometry

7.G.1	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.
8.G.1	Verify experimentally the properties of rotations, reflections, and translations:
8.G.1a	Lines are taken to lines, and line segments to line segments of the same length.
8.G.1b	Angles are taken to angles of the same measure.
8.G.1c	Parallel lines are taken to parallel lines.
8.G.2	Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.
8.G.3	Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.
8.G.4	Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two dimensional figures, describe a sequence that exhibits the similarity between them.
8.G.5	Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles.

GRAPHS

How do you graph linear equations to determine the slope of a line?

Holt Grade 7	Chapter 5	MP 3 Weeks 8-10
Holt Grade 8	Chap. 8 & 9	MP 3 Weeks 8-10

BIG IDEAS

- Analyze proportional relationships and use them to solve real-world and mathematical problems.
- Investigate patterns of association in bivariate data.
- Understand the connections between proportional relationships, lines, and linear equations.

ENDURING UNDERSTANDINGS

Statistics and Probability

8.SP.1	Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.

Ratios and Proportional Relationships

7.RP.1 [M]	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.
7.RP.2 [M]	Recognize and represent proportional relationships between quantities.
7.RP.2a [M]	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.
7.RP.2b [M]	Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.

7.RP.2c [M] 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.

7.RP.2d [M] 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.

Expressions and Equations

8.EE.5 Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways.

8.EE.6 Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation y = mx for a line through the origin and the equation y= mx + b for a line intercepting the vertical axis at b.

PERCENTS

What are effective strategies to solve a wide variety of percentage problems?

Chapter 6 MP 2 Weeks 9-10

BIG IDEAS

- Analyze proportional relationships and use them to solve real-world and mathematical problems.
- Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.
- Use properties of operations to generate equivalent expressions.
- Solve real-life and mathematical problems using numerical and algebraic expressions and equations.

ENDURING UNDERSTANDINGS

Career Education Integration

9.2.8.B.3 Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.

9.2.8.B.4 Evaluate how traditional and nontraditional careers have evolved regionally, nationally, and globally.

9.2.8.B.5 Analyze labor market trends using state and federal labor market information and other resources available online.

Connection: Create word problems based upon career choices. Teachers can use percentage problems to represent the percentage of adults in different career fields.

Ratios and Proportional Relationships

7.RP.3 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.

The Number System

7.NS.1d Apply properties of operations as strategies to add and subtract rational numbers.

7.NS.2a 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.

7.NS.2b 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.

7.NS.2c Apply properties of operations as strategies to multiply and divide rational numbers.

Expressions and Equations

7.EE.2 [M] 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."

7.EE.3 [M] 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.

COLLECTING, DISPLAYING, AND ANALYZING DATA

What are some ways to present summarized data?

Chapter 7 MP 4 Weeks 9-10

BIG IDEAS

- Use random sampling to draw inferences about a population.
- Draw informal comparative inferences about two populations.

ENDURING UNDERSTANDINGS

Statistics and Probability

7.SP.1 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 tends to produce representative samples and support valid inferences.

7.SP.2 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 based on randomly sampled survey data. Gauge how far off the estimate or prediction might be.

7.SP.3 Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, 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.

7.SP.4 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.

GEOMETRIC FIGURES

How do you solve geometric problems with missing measurements?

Chapter 8 MP 4 Weeks 1-2

BIG IDEAS

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

ENDURING UNDERSTANDINGS

Geometry

7.G.2	Draw (with technology, with ruler and protractor as well as freehand) 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.
7.G.5	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.

MEASUREMENT AND GEOMETRY

How do you calculate the area and volume of figures?

Holt Grade7 Chapter 9 MP 4 Weeks 3-9
Holt Grade 8 Chapter 5 MP 4 Weeks 3-9

BIG IDEAS

- 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.
- Understand congruence and similarity using physical models, transparencies, or geometry software.

ENDURING UNDERSTANDINGS

Geometry

7.G.3	Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.
7.G.4	Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle.
7.G.6	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.
8.G.3	Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.

PROBABILITY

How can you make predictions based on probability?

Chapter 10 MP 3 Week 10

BIG IDEAS

- Investigate chance processes and develop, use, and evaluate probability models.

ENDURING UNDERSTANDINGS

Statistics and Probability

7.SP.5	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.
7.SP.6	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.
7.SP.7	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.
7.SP.7a	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.
7.SP.7b	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?
7.SP.8	Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.
7.SP.8a	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.
7.SP.8b	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.
7.SP.8c	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?

MULTI-STEP EQUATIONS AND INEQUALITIES

What are the best procedures to solve multistep problems efficiently?

Holt Grade 7 Chapter 11 MP 3 Weeks 3-8
Holt Grade 8 Chapter 7 MP 3 Weeks 3-8

BIG IDEAS

- Use properties of operations to generate equivalent expressions.
- Solve real-life and mathematical problems using numerical and algebraic expressions and equations.
- Analyze and solve linear equations and pairs of simultaneous linear equations.

ENDURING UNDERSTANDINGS

Expressions and Equations

7.EE.1 Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.

7.EE.4 [M] 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.

7.EE.4a [M] 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 width?

7.EE.4b [M] 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.

8.EE.7 Solve linear equations in one variable.

ALGEBRA PREREQUISITES

What skills and concepts are important for algebra?

MP 4 Weeks 12-13

BIG IDEAS

- Work with radicals and integer exponents.
- Define, evaluate, and compare functions.
- Use functions to model relationships between quantities.
- Know that there are numbers that are not rational, and approximate them by rational numbers.
- Understand and apply the Pythagorean Theorem.

ENDURING UNDERSTANDINGS <u>HOLT 8</u>

The Number System

8.NS.1 Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number. **Chapter 1**

Expressions and Equations

8.EE.1 Know and apply the properties of integer exponents to generate equivalent numerical expressions.

8.EE.3 Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. **Chapter 3**

Functions

8.F.3 Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear.

8.F.4 Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values. **Chapters 2 and 9**

Geometry

8.G.7 Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions. **Chapter 3**

SEVENTH GRADE
PRE-ALGEBRA HONORS

Mathematics Emphasis in Grade 7 Honors

- Develop a unified understanding of numbers, recognizing fractions, decimals, and percents as different representations of rational numbers.
- Formulate expressions and equations in one variable and use these equations to solve problems.
- Develop an understanding of integer exponents, and work with numbers written in scientific notation.
- Use linear equations and systems of linear equations to represent, analyze, and solve a variety of problems (proportion/slope).
- Compare two data distributions and analyze differences between them.
- Solve problems involving area, circumference and volume of objects.
- Examine the relationship of lines and angles in a variety of contexts.

PARCC Grade Level Fluency Expectations

1. Know that there are numbers that are not rational, and approximate them by rational numbers.
   The Number System: 8.NS.1&2

2. Work with radicals and integer exponents.
   Expressions and Equations: 8.EE.1-4

3. Understand the connections between proportional relationships, lines, and linear equations.
   Expressions and Equations: 8.EE.5-6

4. Analyze and solve linear equations and pairs of simultaneous linear equations.
   Expressions and Equations: 8.EE.7

5. Understand congruence and similarity using physical models, transparencies, or geometry software.
   Geometry: 8.G.1-5

6. Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.
   Geometry: 8.G.9

THE LANGUAGE OF ALGEBRA

How can you use numbers and symbols to represent mathematical ideas?

Chapter 1 MP 1 Weeks 2-4

BIG IDEAS

- Apply and extend previous understandings of operations with fractions.
- Use properties of operations to generate equivalent expressions.
- Solve real-life and mathematical problems using numerical and algebraic expressions and equations.

ENDURING UNDERSTANDINGS

The Number System

7.NS.3 Solve real-world and mathematical problems involving the four operations with rational numbers.

Expressions & Equations

7.EE.1 Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.

7.EE.2 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."

7.EE.3 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.

7.EE.4 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.

OPERATIONS WITH INTEGERS

What happens when you add, subtract, multiply, and divide with integers?

Chapter 2 MP 1 Weeks 5-7

BIG IDEAS

- Apply and extend previous understandings of operations with fractions.
- Solve real-life and mathematical problems using numerical and algebraic expressions and equations.

ENDURING UNDERSTANDINGS

The Number System

7.NS.1 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.

7.NS.1a [M] 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.

7.NS.1b [M] 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.

7.NS.1c [M] 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 their difference, and apply this principle in real-world contexts.

7.NS.1d Apply properties of operations as strategies to add and subtract rational numbers.

7.NS.2 Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.

7.NS.2a 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.

7.NS.2b [M] 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.

7.NS.2c Apply properties of operations as strategies to multiply and divide rational numbers.

7.NS.3 Solve real-world and mathematical problems involving the four operations with rational numbers.

Expressions & Equations

7.EE.3 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.

OPERATIONS WITH RATIONAL NUMBERS

What happens when you add, subtract, multiply, and divide rational numbers?

Chapter 3 MP 1 Weeks 8-10

BIG IDEAS

- Apply and extend previous understandings of operations with fractions.
- Know that there are numbers that are not rational, and approximate them by rational numbers.
- Solve real-life and mathematical problems using numerical and algebraic expressions and equations.

ENDURING UNDERSTANDINGS

The Number System

7.NS.1 [M] 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.

7.NS.1d [M] Apply properties of operations as strategies to add and subtract rational numbers.
7.NS.2 [M] Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.
7.NS.2a [M] 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.
7.NS.2c [M] Apply properties of operations as strategies to multiply and divide rational numbers.
7.NS.2d [M] 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.
7.NS.3 [M] Solve real-world and mathematical problems involving the four operations with rational numbers.
8.NS.1 Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.

Expressions & Equations

7.EE.3 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.

POWERS AND ROOTS

Why is it useful to write numbers in different ways?

Chapter 4 MP 4 Weeks 3-4

BIG IDEAS

- Apply and extend previous understandings of operations with fractions.
- Expressions and Equations Work with radicals and integer exponents.

ENDURING UNDERSTANDINGS

The Number System

8.NS.1 Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.
8.NS.2 Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π2). For example, by truncating the decimal expansion of $\sqrt{2}$, show that $\sqrt{2}$ is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.

Expressions & Equations

8.EE.1 [M] Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, $32 \times 3^{-5} = 3^{-3} = 1/33 = 1/27$.

8.EE.2 [M] Use square root and cube root symbols to represent solutions to equations of the form x2 = p and x3 = p, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.

8.EE.3 [M] Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. For example, estimate the population of the United States as 3 times 108 and the population of the world as 7 times 109, and determine that the world population is more than 20 times larger.

8.EE.4 [M] Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.

RATIOS, PROPORTION, AND SIMILAR FIGURES

How can you identify and represent proportional relationships?

Chapter 5 MP 2 Weeks 1-4

BIG IDEAS

- Apply and extend previous understandings of operations with fractions.
- Understand the connections between proportional relationships, lines, and linear equations.
- Analyze proportional relationships and use them to solve real-world and mathematical problems.
- Draw construct, and describe geometrical figures and describe the relationships between them.

ENDURING UNDERSTANDINGS

The Number System

7.NS.3 [M] Solve real-world and mathematical problems involving the four operations with rational numbers.

Expressions & Equations

8.EE.5 Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.

Ratios & Proportional Relationships

7.RP.1 [M] 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.

7.RP.2 Recognize and represent proportional relationships between quantities.

7.RP.2a [M] 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.

7.RP.2b [M] Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.

7.RP.2c 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.

7.RP.2d [M] 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.

7.RP.3 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.

Geometry

7.G.1 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.

PERCENTS

How can you use proportional relationships to solve real-world percent problems?

Chapter 6 MP 2 Weeks 4-6

BIG IDEAS

- Use properties of operations to generate equivalent expressions.
- Solve real-life and mathematical problems using numerical and algebraic expressions and equations.
- Analyze proportional relationships and use them to solve real-world and mathematical problems.

ENDURING UNDERSTANDINGS

Career Education Integration

9.2.8.B.3 Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.

9.2.8.B.4 Evaluate how traditional and nontraditional careers have evolved regionally, nationally, and globally.

9.2.8.B.5 Analyze labor market trends using state and federal labor market information and other resources available online.

Connection: Create word problems based upon career choices. Teachers can use percentage problems to represent the percentage of adults in different career fields.

Expressions & Equations

7.EE.2 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."

7.EE.3 [M] 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.

Ratios & Proportional Relationships

7.RP.2 Recognize and represent proportional relationships between quantities.

7.RP.2c 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.

7.RP.3 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.

ALGEBRAIC EXPRESSIONS

Why are algebraic rules useful?

Chapter 7 MP 2 Weeks 8-9

BIG IDEAS

- Use properties of operations to generate equivalent expressions.
- Apply and extend previous understandings of operations with fractions.

ENDURING UNDERSTANDINGS

Expressions & Equations

7.EE.1 [M] Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.

7.EE.2 [M] 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."

The Number System

7.NS.2 Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.

EQUATIONS AND INEQUALITIES

How are equations and inequalities used to describe and solve multistep problems?

Chapter 8 MP 2 Weeks 10-11

BIG IDEAS

- Solve real-life and mathematical problems using numerical and algebraic expressions and equations.
- Analyze and solve linear equations and pairs of simultaneous linear equations.
- Define, evaluate, and compare functions.
- Use functions to model relationships between quantities.
- Investigate patterns of association in bivariate data.

ENDURING UNDERSTANDINGS

Expressions & Equations

7.EE.4 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.

7.EE.4a [M] 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 width?

7.EE.4b [M] 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.

8.EE.7 [M] Solve linear equations in one variable.

8.EE.7a [M] Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form x = a, a = a, or a = b results (where a and b are different numbers).

8.EE.7b [M] Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.

8.EE.8a [M] Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.

8.EE.8b [M] Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. For example, 3x + 2y = 5 and 3x + 2y = 6 have no solution because 3x + 2y cannot simultaneously be 5 and 6.

8.EE.8c [M] Solve real-world and mathematical problems leading to two linear equations in two variables. For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.

Functions

8.F.3 [M] Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. For example, the function A = s2 giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.

8.F.4 Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.

Statistics and Probability

8.SP.3 Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.

LINEAR FUNCTIONS

How are linear functions used to model proportional relationships?

Chapter 9 MP 3 Weeks 1-2

BIG IDEAS

- Solve real-life and mathematical problems using numerical and algebraic expressions and equations.
- Understand the connections between proportional relationships, lines, and linear equations.
- Analyze and solve linear equations and pairs of simultaneous linear equations.
- Analyze proportional relationships and use them to solve real-world and mathematical problems.
- Define, evaluate, and compare functions.
- Use functions to model relationships between quantities.

ENDURING UNDERSTANDINGS

Expressions & Equations

7.EE.4 [M] 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.

8.EE.5 [M] Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.

8.EE.6 [M] Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b.

8.EE.8 Analyze and solve pairs of simultaneous linear equations.

Functions

8.F.1 [M] Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.

8.F.2 [M] Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.

8.F.5 Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

Ratios & Proportional Relationships

7.RP.2 Recognize and represent proportional relationships between quantities.

7.RP.2a 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.

STATISTICS AND PROBABILITY

How are statistics used to draw inferences about and compare populations?

Chapter 10 MP 3 Weeks 3-5

BIG IDEAS

- 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.
- Investigate patterns of association in bivariate data.

ENDURING UNDERSTANDINGS

Statistics & Probability

7.SP.1 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 tends to produce representative samples and support valid inferences.

7.SP.2	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 based on randomly sampled survey data. Gauge how far off the estimate or prediction might be.
7.SP.3	Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, 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.
7.SP.4	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.
7.SP.5	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.
7.SP.6	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.
7.SP.7	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.
7.SP.7a	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.
7.SP.7b	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?
7.SP.8	Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.
7.SP.8	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.
7.SP.8b	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.
7.SP.8c	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?

Statistics and Probability

8.SP.1	Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.

8.SP.2 Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.

8.SP.4 Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?

CONGRUENCE, SIMILARITY, AND TRANSFORMATIONS

How can you determine congruence and similarity?

Chapter 11 MP 3 Weeks 6-9

BIG IDEAS

- 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.
- Understand congruence and similarity using physical models, transparencies, or geometry software.
- Understand and apply the Pythagorean Theorem.

ENDURING UNDERSTANDINGS

Geometry

7.G.2 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.

7.G.5 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.

8.G.1 [M] Verify experimentally the properties of rotations, reflections, and translations.

8.G.1a [M] Lines are taken to lines, and line segments to line segments of the same length.

8.G.1b [M] Angles are taken to angles of the same measure.

8.G.1c [M] Parallel lines are taken to parallel lines.

8.G.2 [M] Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.

8.G.3 [M] Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.

8.G.4 [M] Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.

8.G.5 [M] Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. For example, arrange three copies of the

same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.

8.G.6 [M] Explain a proof of the Pythagorean Theorem and its converse.

8.G.7 [M] Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.

8.G.8 [M] Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

VOLUME AND SURFACE AREA

How are 2D figures used to solve problems involving 3D figures?

Chapter 12 MP 3 Weeks 6-9

BIG IDEAS

- 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.
- Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.

ENDURING UNDERSTANDINGS

Geometry

7.G.3 Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.

7.G.4 Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle.

7.G.6 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.

8.G.9 Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

SEVENTH GRADE

RESOURCE ROOM

PRE-ALGEBRA

Mathematics Emphasis in Grade 7

- Analyze proportional relationships and use them to solve real-world and mathematical problems.
- Apply and extend previous understandings of operations with fractions to add, subtract, multiply and divide rational numbers.
- Use properties of operations to generate equivalent expressions.
- Solve real-life and mathematical problems using numerical and algebraic expressions and equations.
- This course is made up of two textbooks Holt 7 & Holt 8

PARCC Grade Level Fluency Expectations

1. Solve real-life and mathematical problems using numerical and algebraic expressions and equations. Expressions and Equations: 7.EE.3-4

2. Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.
   The Number System: 7.NS.1

Major Within Grade Dependencies

- Meeting standard 7.EE.3 in its entirety will involve using rational number arithmetic (7.NS.1-3) and percents (7.RP.3). Work leading to meeting this standard could be organized as a recurring activity that tracks the students' ongoing acquisition of new skills in rational number arithmetic and percents.
- Because rational number arithmetic (7.NS.1-3) underlies the problem solving detailed in 7.EE.3 as well as the solution of linear expressions and equations (7.EE.1-2, 4), this work should likely begin at or near the start of the year.
- The work leading to meeting standards 7.EE.1-4 could be divided into two phases, one centered on addition and subtraction (e.g., solving $x + q = r$) in relation to rational number addition and subtraction (7.NS.1) and another centered on multiplication and division (e.g., solving $px + q = r$ and $p(x + q) = r$) in relation to rational number multiplication and division (7.NS.2).

ALGEBRAIC REASONING

How do you apply properties of operations to solve equations?

Chapter 1 MP 1 Weeks 2-3

BIG IDEAS

- Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.
- Use properties of operations to generate equivalent expressions.
- Solve real-life and mathematical problems using numerical and algebraic expressions and equations.

ENDURING UNDERSTANDINGS

The Number System

7.NS.1d [M] Apply properties of operations as strategies to add and subtract rational numbers.

Expressions and Equations

7.EE.1 [M] Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.

7.EE.2 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."

7.EE.3 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.

7.EE.4 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.

INTEGERS AND RATIONAL NUMBERS

How do you apply properties of operations when solving equations with integers?

Chapter 2 MP 1 Weeks 4-6

BIG IDEAS

- Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.
- Solve real-life and mathematical problems using numerical and algebraic expressions and equations.

ENDURING UNDERSTANDINGS

The Number System

7.NS.1 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.

7.NS.1a [M] Describe situations in which opposite quantities combine to make 0. For example, in the first round of a game, Maria scored 20 points. In the second round of the same game, she lost 20 points. What is her score at the end of the second round?

7.NS.1b 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.

7.NS.1c 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 their difference, and apply this principle in real-world contexts.

7.NS.2 Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.

7.NS.2a 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.

7.NS.2b 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.

7.NS.2c [M] Apply properties of operations as strategies to multiply and divide rational numbers.

7.NS.3 Solve real-world and mathematical problems involving the four operations with rational numbers.

Expressions and Equations

7.EE.4 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.

APPLYING RATIONAL NUMBERS

How do solve equations involving decimals and fractions?

Chapter 3 MP 1 Weeks 7-8

BIG IDEAS

- Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.
- Solve real-life and mathematical problems using numerical and algebraic expressions and equations.

ENDURING UNDERSTANDINGS

The Number System

7.NS.1 [M] 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.

7.NS.1b [M] 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.

7.NS.1c [M] 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 their difference, and apply this principle in real-world contexts.

7.NS.2 [M] Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.

7.NS.2a [M] 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.

7.NS.2b [M] 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.

7.NS.3 [M] Solve real-world and mathematical problems involving the four operations with rational numbers.

Expressions and Equations

7.EE.4 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.

PROPORTIONAL RELATIONSHIPS

How do you use proportionality to solve problems?

Holt Grade 7 Chapter 4 MP 1 Weeks 9-11
Holt Grade 8 Chapter 5 MP 2 Weeks 4-6

BIG IDEAS

- Analyze proportional relationships and use them to solve real-world and mathematical problems.
- Draw, construct, and describe geometrical figures and describe the relationships between them.
- Understand congruence and similarity using physical models, transparencies, or geometry software.

ENDURING UNDERSTANDINGS

Ratios and Proportional Relationships

7.RP.1 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.

7.RP.2 Recognize and represent proportional relationships between quantities.

7.RP.2a 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.

7.RP.2b Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.

7.RP.2c 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.

Geometry

7.G.1 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.

8.G.1 Verify experimentally the properties of rotations, reflections, and translations:

8.G.1a	Lines are taken to lines, and line segments to line segments of the same length.
8.G.1b	Angles are taken to angles of the same measure.
8.G.1c	Parallel lines are taken to parallel lines.
8.G.2	Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.
8.G.3	Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.
8.G.4	Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two dimensional figures, describe a sequence that exhibits the similarity between them.
8.G.5	Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles.

GRAPHS

How do you graph linear equations to determine the slope of a line?

Holt Grade 7	Chapter 5	MP 2 Weeks 1-3
Holt Grade 8	Chap. 8 & 9	MP 3 Weeks 4-6

BIG IDEAS

- Analyze proportional relationships and use them to solve real-world and mathematical problems.
- Investigate patterns of association in bivariate data.
- Understand the connections between proportional relationships, lines, and linear equations.

ENDURING UNDERSTANDINGS

Statistics and Probability

8.SP.1	Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.

Ratios and Proportional Relationships

7.RP.1 [M]	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.
7.RP.2 [M]	Recognize and represent proportional relationships between quantities.
7.RP.2a [M]	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.
7.RP.2b [M]	Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.
7.RP.2c [M]	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 $t = pn$.
7.RP.2d [M]	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.

Expressions and Equations

8.EE.5 Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways.

8.EE.6 Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation y = mx for a line through the origin and the equation y= mx + b for a line intercepting the vertical axis at b.

PERCENTS

What are effective strategies to solve a wide variety of percentage problems?

Chapter 6 MP 2 Weeks 4-6

BIG IDEAS

- Analyze proportional relationships and use them to solve real-world and mathematical problems.
- Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.
- Use properties of operations to generate equivalent expressions.
- Solve real-life and mathematical problems using numerical and algebraic expressions and equations.

ENDURING UNDERSTANDINGS

Career Education Integration

9.2.8.B.3 Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.

9.2.8.B.4 Evaluate how traditional and nontraditional careers have evolved regionally, nationally, and globally.

9.2.8.B.5 Analyze labor market trends using state and federal labor market information and other resources available online.

Connection: Create word problems based upon career choices. Teachers can use percentage problems to represent the percentage of adults in different career fields.

Ratios and Proportional Relationships

7.RP.3 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.

The Number System

7.NS.1d Apply properties of operations as strategies to add and subtract rational numbers. 7.NS.2a 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.

7.NS.2b 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.

7.NS.2c Apply properties of operations as strategies to multiply and divide rational numbers. Expressions and Equations

Expressions and Equations

7.EE.2 [M] 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."

7.EE.3 [M] 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.

COLLECTING, DISPLAYING, AND ANALYZING DATA

What are some ways to present summarized data?

Chapter 7 MP 2 Weeks 7-8

BIG IDEAS

- Use random sampling to draw inferences about a population.
- Draw informal comparative inferences about two populations.

ENDURING UNDERSTANDINGS

Statistics and Probability

7.SP.1 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 tends to produce representative samples and support valid inferences.

7.SP.2 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 based on randomly sampled survey data. Gauge how far off the estimate or prediction might be.

7.SP.3 Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, 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.

7.SP.4 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.

GEOMETRIC FIGURES

How do you solve geometric problems with missing measurements?

Chapter 8 MP 2 Weeks 9-10

BIG IDEAS

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

ENDURING UNDERSTANDINGS

Geometry

7.G.2	Draw (with technology, with ruler and protractor as well as freehand) 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.
7.G.5	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.

MEASUREMENT AND GEOMETRY

How do you calculate the area and volume of figures?

Holt Grade 7	Chapter 9	MP 3 Weeks 1-3
Holt Grade 8	Chapter 5	MP 2 Weeks 4-6

BIG IDEAS

- 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.
- Understand congruence and similarity using physical models, transparencies, or geometry software.

ENDURING UNDERSTANDINGS

Geometry

7.G.3	Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.
7.G.4	Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle.
7.G.6	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.
8.G.3	Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.

PROBABILITY

How can you make predictions based on probability?

Chapter 10 MP 3 Weeks 4-6

BIG IDEAS

- Investigate chance processes and develop, use, and evaluate probability models.

ENDURING UNDERSTANDINGS

Statistics and Probability

7.SP.5	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 ½ indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.
7.SP.6	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.
7.SP.7	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.
7.SP.7a	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.
7.SP.7b	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?
7.SP.8	Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.
7.SP.8a	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.
7.SP.8b	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.
7.SP.8c	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?

MULTI-STEP EQUATIONS AND INEQUALITIES

What are the best procedures to solve multistep problems efficiently?

Holt Grade 7 Chapter 11 MP 3 Weeks 7-10
Holt Grade 8 Chapter 7 MP 3 Weeks 1-3

BIG IDEAS

- Use properties of operations to generate equivalent expressions.
- Solve real-life and mathematical problems using numerical and algebraic expressions and equations.
- Analyze and solve linear equations and pairs of simultaneous linear equations.

ENDURING UNDERSTANDINGS

Expressions and Equations

7.EE.1 Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.

7.EE.4 [M] 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.

7.EE.4a [M] 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 width?

7.EE.4b [M] 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.

8.EE.7 Solve linear equations in one variable.

ALGEBRA PREREQUISITES

What skills and concepts are important for algebra?

MP 4

BIG IDEAS

- Work with radicals and integer exponents.
- Define, evaluate, and compare functions.
- Use functions to model relationships between quantities.
- Know that there are numbers that are not rational, and approximate them by rational numbers.
- Understand and apply the Pythagorean Theorem.

ENDURING UNDERSTANDINGS - HOLT 8

The Number System

8.NS.1 Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal

expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number. Chapter 1

Expressions and Equations

8.EE.1 Know and apply the properties of integer exponents to generate equivalent numerical expressions.

8.EE.3 Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. Chapter 3

Functions

8.F.3 Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear.

8.F.4 Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values. Chapters 2 and 9

Geometry

8.G.7 Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions. Chapter 3

EIGHTH GRADE
ALGEBRA I

Mathematics Emphasis in Grade 8 Algebra I

- Understand the real number system as an extension to previously recognized rational and irrational numbers.
- Solve problems in which reasoning about units adds insight.
- Use properties of operations to rewrite expressions, gaining fluency and engaging in "mindful manipulation."
- Master linear and quadratic functions.
- Solidify understanding of the analytic geometry of lines (Cartesian coordinate plane)
- Apply the study of algebra and functions in a statistical context.
- Solve complex word problems.

PARCC Algebra I Fluency Expectations

1. Become fluent in solving characteristic problems involving the analytic geometry of lines, such as writing down the equation of a line given a point and a slope.
   Interpreting Categorical & Quantitative Data: S.ID.7-9

2. Fluency in adding, subtracting, and multiplying polynomials.
   Arithmetic with Polynomials & Rational Expressions: HSA-APR.1

3. Fluency in transforming expressions and chunking (seeing parts of an expression a single object).
   Seeing Structure in Expressions: HSA-SSE.1b

EQUATIONS

How can students apply ratios and proportions to model real-world situations such as shopping?

Chapter 1 MP 1 Weeks 2-4

BIG IDEAS

- Properties of equality.
- Using inverse operations to solve equations containing variables.
- Writing equations to represent situations.
- Simplify equations before solving.
- Solve equations and proportions
- Precision and accuracy.

ENDURING UNDERSTANDINGS

Career Education Integration

9.2.8.B.3 Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.

9.2.8.B.4 Evaluate how traditional and nontraditional careers have evolved regionally, nationally, and globally.

9.2.8.B.5 Analyze labor market trends using state and federal labor market information and other resources available online.

9.2.8.B.6 Demonstrate understanding of the necessary preparation and legal requirements to enter the workforce.

Connection: Students are expected to apply ration and proportions to real world situations – this can be applied to a variety of career choices. Students can create equations based upon different labor market trends and career path decisions.

Seeing Structure in Expressions

A.SSE.1a Interpret parts of an expression, such as terms, factors, and coefficients. Seeing structures in expressions.

Expressions and Equations

8.EE.8 Analyze and solve linear equations and pairs of simultaneous linear equations.

Reasoning with Equations & Inequalities

A.REI.A1 [M] Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

- Solving Equations by Adding or Subtracting
- Solving Equations by Multiplying or Dividing
- Solving Two-Step and Multi-Step Equations
- Solving Equations with Variables on Both Sides

Creating Equations

A.CED.A4 [M] Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law V = IR to highlight resistance R.

- Solving for a Variable

A.CED.A1 [M] Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.

- Solving Absolute-Value Equations

Quantities

N.Q.A1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

- Rates, Ratios, and Proportions
- Applications of Proportions

N.Q.A3 Choose a level of accuracy appropriate to limitations on measurement when reporting qualities.

- Precision and Accuracy

INEQUALITIES

How can students write, solve, and graph inequalities to determine real-life costs such as calculating all costs of a vacation?

Chapter 2 MP 1 Weeks 5-6

BIG IDEAS

- Properties of inequality.
- Using inverse operations to solve inequalities.
- Writing inequalities to represent situations.
- Simplify inequalities before solving.
- Solving compound and absolute-value inequalities.

ENDURING UNDERSTANDINGS

Reasoning with Equations & Inequalities

A.REI.B3 [M] Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

- Graphing and Writing Inequalities
- Solving Inequalities by Adding or Subtracting
- Solving Inequalities by Multiplying or Dividing
- Solving Two-Step and Multi-Step Inequalities
- Solving Inequalities with Variables on Both Sides
- Solving Compound Inequalities
- Solving Absolute-Value Inequalities

FUNCTIONS

Why are graphs useful and how can we apply them to everyday situations such as real-world travel?

Chapter 3 MP 1 Weeks 8-10

BIG IDEAS

- Relationships between variables.
- Determine whether a relation is a function.
- Use function notation.
- Use trend lines on scatter plots to make predictions.
- Arithmetic sequences.

MATHEMATICS: Eighth Grade – Algebra I

ENDURING UNDERSTANDINGS

Interpreting Functions

F.LE.A1a Linear, quadratic, and exponential models. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.

F.LE.A1b Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.

- Relations and Functions

F.IF.A2 Use function notation, evaluate functions for inputs in their domains, and interprets statements that use function notation in terms of a context.

- Writing Functions

F.IF.A3 [M] Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. For example, the Fibonacci sequence is defined recursively by $f(0) = f(1) = 1$, $f(n+1) = f(n) + f(n-1)$ for $n \geq 1$.

- Arithmetic Sequences

F.IF.B4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.

- Graphing Relationships

F.IF.B5[M] Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.

- Graphing Functions

Functions

8.F.A1 [M] Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.

8.F.A2 [M] Compare properties (e.g. rate of change, intercepts, domain and range) of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.*

8.F.A3 [M] Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. *For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.*

8.F.B4 Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.

8.F.B5 Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

Interpreting Categorical and Quantitative Data

S.ID.B6 Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.

- Scatter-Plots and Trend Lines

LINEAR FUNCTIONS

How can students use linear functions to model and solve problems that use everyday situations such as walking at constant speeds?

Chapter 4A MP 2 Weeks 1-3
Chapter 4B MP 2 Weeks 3-5

BIG IDEAS

- Write and graph linear functions.
- Identify and interpret the components of linear graphs, including slope and intercepts.
- Slope-intercept and point-slope forms.
- Parallel and perpendicular lines.
- Transform linear functions.
- Determine the line of best fit.

ENDURING UNDERSTANDINGS

Reasoning with Equations & Inequalities

A.REI.D10 Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).
- Identifying Linear Functions

Interpreting Functions

F.IF.B6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.
- Rate of Change and Slope
- The Slope Formula

F.IF.C7a Graph linear and quadratic functions and show intercepts, maxima, and minima.
- Using Intercepts

Creating Equations

A.CED.A2 [M] Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
- Direct Variation
- Slope-Intercept Form
- Point-Slope Form

Interpreting Categorical & Quantitative Data

S.ID.B6 Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.
- Line of Best Fit

Expressing Geometric Properties with Equations

G.GPE.B5 Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of line parallel or perpendicular to a given line that passes through a given point.
- Slopes of Parallel and Perpendicular Lines

Building Functions

F.BF.B3 Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.
- Transforming Linear Functions

SYSTEMS OF EQUATIONS AND INEQUALITIES

How can students use systems of equations to make good business decisions?

Chapter 5 MP 2 Weeks 6-8

BIG IDEAS

- Find a solution that satisfies two linear equations.
- Graph one or more linear inequalities in the coordinate plane.
- Find solutions that satisfy two linear inequalities.

ENDURING UNDERSTANDINGS

Reasoning with Equations & Inequalities

A.REI.C5 [M] Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.

A.REI.C6 [M] Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.

- Solving Systems by Graphing
- Solving Systems by Substitution
- Solving Systems by Elimination

A.REI.D12[M] Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.

- Solving Linear Inequalities
- Solving Systems of Linear Inequalities

EXPONENTS AND POLYNOMIALS

How can students write, solve, and graph equations to model real-world situations such as using area to carpet the floors in a building?

Chapter 6 MP 2 Weeks 10-11

BIG IDEAS

- Determine all properties of exponents.
- Add, subtract, and multiply polynomials by using properties of exponents and combining like terms.
- Closure of polynomials.

ENDURING UNDERSTANDINGS

The Real Number System

N.RN.A1 Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. For example, we define 51/3 to be the cube root of 5 because we want (51/3)3 = 5(1/3)3 to hold, so (51/3)3 must equal 5.

- Integer Exponents
- Rational Exponents

Seeing Structure in Expressions

A.SSE.A1a[M] Interpret parts of an expression, such as terms, factors, and coefficients.

- Polynomials

Arithmetic with Polynomials & Rational Expressions

A.APR.A1 Understand that polynomials form a system analogues to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.

- Adding and Subtracting Polynomials
- Multiplying Polynomials
- Special Products of Polynomials

FACTORING POLYNOMIALS

How can students write and factor polynomials to model distances and dimensions in the real-world?

Chapter 7 MP 3 Weeks 1-2

BIG IDEAS

- Find greatest common factors.
- Factor polynomials.
- Factor perfect-square trinomials and differences of squares.
- Choosing a factoring method.

ENDURING UNDERSTANDINGS

Seeing Structure in Expressions

A.SSE.A2 Use the structure of an expression to identify ways to rewrite it. For example, see x4 – y4 as (x2)2 – (y2)2, thus recognizing it as a difference of squares that can be factored as (x2 – y2)(x2 + y2).

- Factors and the Greatest Common Factors
- Factoring by GCF
- Factoring x^2 + bx + c
- Factoring ax^2 + bx + c
- Factoring Special Products
- Choosing a Factoring Method

A.SSE.B3a Factor a quadratic expression to reveal the zeros of the function it defines.

- Using a Graph to Factor Polynomials (Lab)

QUADRATIC FUNCTIONS AND EQUATIONS

When could a nonlinear function be used to model a real-world situation?

Chapter 8 MP 3 Weeks 3-6

BIG IDEAS

- Identify and graph quadratic functions.
- Transform quadratic functions.
- Use various methods to solve quadratic equations, systems with one linear and one quadratic equation, and nonlinear systems.

MATHEMATICS: Eighth Grade – Algebra I

ENDURING UNDERSTANDINGS

Interpreting Functions

F.IF.C7a Graph linear and quadratic functions and show intercepts, maxima, and minima.

F.IF.C7b Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

- Identifying Quadratic Functions
- Characteristics of Quadratic Functions
- Graphing Quadratic Functions

Building Functions

F.BF.B3 Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.

- Transforming Quadratic Functions

Reasoning with Equations & Inequalities

A.REI.D11[M] Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.

- Solving Quadratic Equations by Graphing

Geometry- Understand and apply the Pythagorean Theorem

8.G.B6 [M] Explain a proof of the Pythagorean Theorem and its converse.

8.G.B7 [M] Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.

8.G.B8 [M] Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

Reasoning with Equations & Inequalities

A.REI.B4 Solve quadratic equations in one variable.

A.REI.B4a[M] Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x – p)2 = q$ that has the same solutions. Derive the quadratic formula from this form.

- Completing the Square

A.REI.B46[M] Solve quadratic equations by inspection (e.g., for $x2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b.

- Solving Quadratic Equations by Factoring
- Solving Quadratic Equations by Using Square Roots
- The Quadratic Formula and the Discriminant

A.REI.C7 Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line $y=-3x$ and the circle $x2 + y2 = 3$.

- Nonlinear Systems

Interpreting Functions

F.I.F.C7c Graph polynomial functions, identifying zeros and asymptotes when suitable factorizations are available, and showing behavior.

- Extension Lesson: Cubic Functions and Equations

Arithmetic with Polynomials and Rational Expressions

A.APR.B3 Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.

EXPONENTIAL FUNCTIONS

How can students evaluate exponential functions and apply them to real-world situations such as population growth?

Chapter 9 MP 4 Weeks 3-4

BIG IDEAS

- Understanding geometric sequences.
- Fluently work with exponential functions.
- Compare functions and rates of change.

ENDURING UNDERSTANDINGS

Interpreting Functions

F.IF.A3 [M] Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. For example, the Fibonacci sequence is defined recursively by $f(0) = f(1) = 1$, $f(n+1) = f(n) + f(n-1)$ for $n \geq 1$.
- Geometric Sequences

F.IF.C7e Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.
- Exponential Functions

F.IF.C9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
- Comparing Functions

Linear, Quadratic, & Exponential Models

F.LE.A2 Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
- Exponential Growth and Decay

F.LE.A1 Distinguish between situations that can be modeled with linear functions and with exponential functions.
- Linear, Quadratic, and Exponential Models

DATA ANALYSIS AND PROBABILITY

How can students use graphs, statistics, and probability to model real-life situations such as the Olympic Games?

Chapter 10 MP 4 Weeks 5-7

BIG IDEAS

- Ability to organize data into tables and graphs.
- Calculate the mean, median, and mode of a data set.
- Understand shapes of distributions.
- Experimental and theoretical probability.
- Independent and dependent events.

ENDURING UNDERSTANDINGS

Interpreting Categorical & Quantitative Data

S.I.D. A1[M] Represent data with plots on the real number line (dot plots, histograms, and box plots).
- Organizing and Displaying Data

- Frequency and Histograms

S.I.D.A2[M] Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.

- Data Distributions

Statistics and Probability

8.SP.1 Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.

8.SP.2 Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit (e.g. line of best fit) by judging the closeness of the data points to the line.

8.SP.3 Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. *For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.*

8.SP.4 Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. *For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?*

Making Inferences and Justifying Conclusions

S.IC.A1 Making inferences and justifying conclusions. Understand statistics as a process for making inferences about population parameters based on a random sample from that population.

- Use Random Numbers

S.I.C.6 Evaluate reports based on data

- Misleading Graphs and Statistic**s**

Conditional Probability and the Rules of Probability

S.CP.A1 Conditional probability and the rules of probability. Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) or the outcomes, or as unions, intersections, or complements of other events.

- Experimental Probability
- Theoretical Probability

S.CP.A2 Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.

- Independent and Dependent Events

EIGHTH GRADE
ALGEBRA I

Mathematics Emphasis in Grade 8 Algebra I

- Understand the real number system as an extension to previously recognized rational and irrational numbers.
- Solve problems in which reasoning about units adds insight.
- Use properties of operations to rewrite expressions, gaining fluency and engaging in "mindful manipulation."
- Master linear and quadratic functions.
- Solidify understanding of the analytic geometry of lines (Cartesian coordinate plane)
- Apply the study of algebra and functions in a statistical context.
- Solve complex word problems.

PARCC Algebra I Fluency Expectations

1. Become fluent in solving characteristic problems involving the analytic geometry of lines, such as writing down the equation of a line given a point and a slope.
   Interpreting Categorical & Quantitative Data: S.ID.7-9

2. Fluency in adding, subtracting, and multiplying polynomials.
   Arithmetic with Polynomials & Rational Expressions: HSA-APR.1

3. Fluency in transforming expressions and chunking (seeing parts of an expression a single object).
   Seeing Structure in Expressions: HSA-SSE.1b

EXPRESSIONS, EQUATIONS, AND FUNCTIONS

How can mathematical ideas be represented?

Chapter 1 MP1 Weeks 2-4

BIG IDEAS

- Reason quantitatively and use units to solve problems.
- Interpret the structure of expressions.
- Create equations that describe numbers or relationships.
- Solve equations and inequalities in one variable.
- Represent and solve equations and inequalities graphically.
- Understand the concept of a function and use function notation.
- Interpret functions that arise in applications in terms of the context.
- Analyze functions using different representations.

ENDURING UNDERSTANDINGS

Career Education Integration

9.2.8.B.3 Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.

9.2.8.B.4 Evaluate how traditional and nontraditional careers have evolved regionally, nationally, and globally.

9.2.8.B.5 Analyze labor market trends using state and federal labor market information and other resources available online.

9.2.8.B.6 Demonstrate understanding of the necessary preparation and legal requirements to enter the workforce.

Connection: Students are expected to apply ration and proportions to real world situations – this can be applied to a variety of career choices. Students can create equations based upon different labor market trends and career path decisions.

Quantities

N.Q.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

Seeing Structure in Expressions

A.SSE.1a [M] Interpret parts of an expression, such as terms, factors, and coefficients.

A.SSE.1b [M] Interpret complicated expressions by viewing one or more of their parts as a single entity. For example, interpret P(1+r)n as the product of P and a factor not depending on P

A.SSE.2 Use the structure of an expression to identify ways to rewrite it. For example, see x4 – y4 as (x2)2 – (y2)2, thus recognizing it as a difference of squares that can be factored as (x2 – y2)(x2 + y2).

Creating Equations

A.CED.1 Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.

A.CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

Reasoning with Equations & Inequalities

A.REI.10 [M] Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

A.REI.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

Interpreting Functions

F.IF.1 [M] Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a

function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x).

F.IF.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

F.IF.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.

F.IF.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.

LINEAR EQUATIONS

Why is it helpful to represent the same mathematical idea in different ways?

Chapter 2 MP 1 Weeks 5-7

BIG IDEAS

- Reason quantitatively and use units to solve problems.
- Create equations that describe numbers or relationships.
- Understand solving equations as a process of reasoning and explain the reasoning.
- Solve equations and inequalities in one variable.

ENDURING UNDERSTANDINGS

Quantities

N.Q.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

N.Q.2 Define appropriate quantities for the purpose of descriptive modeling.

Creating Equations

A.CED.1 [M] Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.

A.CED.4 [M] Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law V = IR to highlight resistance R.

Reasoning with Equations & Inequalities

A.REI.1 [M] Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

A.REI.3 [M] Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

LINEAR FUNCTIONS

Why are graphs useful?

Chapter 3 MP1 Weeks 8-9

BIG IDEAS

- Reason quantitatively and use units to solve problems.
- Represent and solve equations and inequalities graphically.
- Interpret functions that arise in applications in terms of the context.
- Analyze functions using different representations.

ENDURING UNDERSTANDINGS

Quantities

N.Q.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

Reasoning with Equations & Inequalities

A.REI.10 Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

Interpreting Functions

F.IF.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.

F.IF.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.

F.IF.7a Graph linear and quadratic functions and show intercepts, maxima, and minima.

Building Functions

F.BF.2 Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.

Linear, Quadratic, & Exponential Models

F.LE.1a Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.

F.LE.1b Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.

F.LE.2 Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

EQUATIONS OF LINEAR FUNCTIONS

Why is math used to model real-world situations?

Chapter 4 MP 1 Weeks 9-10
MP 2 Week 1

BIG IDEAS

- Create equations that describe numbers or relationships.
- Understand the concept of a function and use function notation.
- Analyze functions using different representations.
- Build a function that models a relationship between two quantities.

- Build new functions from existing functions.
- Construct and compare linear, quadratic, and exponential models and solve problems.
- Interpret expressions for functions in terms of the situation they model.
- Summarize, represent, and interpret data on two categorical and quantitative variables.
- Interpret linear models.

ENDURING UNDERSTANDINGS

Creating Equations

A.CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

Interpreting Functions

F.IF.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

F.IF.7a Graph linear and quadratic functions and show intercepts, maxima, and minima.

Building Functions

F.BF.4a Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. For example, f(x) =2 x3 or f(x) = (x+1)/(x–1) for x ≠ 1.

Linear, Quadratic, & Exponential Models

F.LE.2 Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

F.LE.5 Interpret the parameters in a linear or exponential function in terms of a context.

Interpreting Categorical & Quantitative Data

S.ID.6 Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.

S.ID.6a Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.

S.ID.6c Fit a linear function for a scatter plot that suggests a linear association.

S.ID.7 [M] Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.

S.ID.8 [M] Compute (using technology) and interpret the correlation coefficient of a linear fit.

S.ID.9 [M] Distinguish between correlation and causation.

LINEAR INEQUALITIES

How are symbols useful in mathematics?

Chapter 5 MP 2 Weeks 2-5

BIG IDEAS

- Create equations that describe numbers or relationships.
- Solve equations and inequalities in one variable.
- Represent and solve equations and inequalities graphically.

ENDURING UNDERSTANDINGS

Creating Equations

A.CED.1 Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.

A.CED.3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.

Reasoning with Equations & Inequalities

A.REI.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

A.REI.12 Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.

SYSTEMS OF LINEAR EQUATIONS AND INEQUALITIES

How can you find the solution to a math problem?

Chapter 6 MP 2 Weeks 7-9

BIG IDEAS

- Create equations that describe numbers or relationships.
- Solve systems of equations.
- Represent and solve equations and inequalities graphically.

ENDURING UNDERSTANDINGS

Creating Equations

A.CED.2 [M] Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

A.CED.3 [M] Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.

Reasoning with Equations & Inequalities

A.REI.5 [M] Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.

A.REI.6 [M] Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.

A.REI.11 [M] Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.

A.REI.12 [M] Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.

EXPONENTS AND EXPONENTIAL FUNCTIONS

What factors can affect good decision making?

Chapter 7 MP 2 Week 10

BIG IDEAS

- Extend the properties of exponents to rational exponents.
- Interpret the structure of expressions.
- Write expressions in equivalent forms to solve problems.
- Represent and solve equations and inequalities graphically.
- Understand the concept of a function and use function notation.
- Interpret functions that arise in applications in terms of the context.
- Analyze functions using different representations.
- Build a function that models a relationship between two quantities.
- Build new functions from existing functions.
- Construct and compare linear, quadratic, and exponential models and solve problems.

ENDURING UNDERSTANDINGS

The Real Number System

N.RN.1 Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. For example, we define 51/3 to be the cube root of 5 because we want (51/3)3 = 5(1/3)3 to hold, so (51/3)3 must equal 5.

N.RN.2 Rewrite expressions involving radicals and rational exponents using the properties of exponents.

Seeing Structure in Expressions

A.SSE.2 Use the structure of an expression to identify ways to rewrite it. For example, see x4 – y4 as (x2)2 – (y2)2, thus recognizing it as a difference of squares that can be factored as (x2 – y2)(x2 + y2).

A.SSE.3c Use the properties of exponents to transform expressions for exponential functions. For example the expression 1.15t can be rewritten as (1.151/12)12t ≈ 1.01212t to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.

Reasoning with Equations & Inequalities

A.REI.11 Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.

Interpreting Functions

F.IF.3 [M] Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. For example, the Fibonacci sequence is defined recursively by f(0) = f(1) = 1, f(n+1) = f(n) + f(n-1) for n ≥ 1.

F.IF.5 [M] Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.

F.IF.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.

F.IF.7e Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

F.IF.8b Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as y = (1.02)t, y = (0.97)t, y = (1.01)12t, y = (1.2)t/10, and classify them as representing exponential growth or decay.

Building Functions

F.BF.1a Determine an explicit expression, a recursive process, or steps for calculation from a context.

F.BF.1b Combine standard function types using arithmetic operations. For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.

F.BF.2 Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms

F.BF.3 Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.

Linear, Quadratic, & Exponential Models

F.LE.1 Distinguish between situations that can be modeled with linear functions and with exponential functions.

F.LE.2 Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

F.LE.3 Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.

QUADRATIC EXPRESSIONS AND EQUATIONS

When could a nonlinear function be used to model a real-world situation?

Chapter 8 MP 3 Weeks 3-5

BIG IDEAS

- Interpret the structure of expressions.
- Write expressions in equivalent forms to solve problems.
- Perform arithmetic operations on polynomials.
- Understand solving equations as a process of reasoning and explain the reasoning.
- Solve equations and inequalities in one variable.

ENDURING UNDERSTANDINGS

Seeing Structure in Expressions

A.SSE.1a [M] Interpret parts of an expression, such as terms, factors, and coefficients.

A.SSE.2 [M] Use the structure of an expression to identify ways to rewrite it. For example, see x4 – y4 as (x2)2 – (y2)2, thus recognizing it as a difference of squares that can be factored as (x2 – y2)(x2 + y2).

A.SSE.3a Factor a quadratic expression to reveal the zeros of the function it defines.

Arithmetic with Polynomials & Rational Expressions

A.APR.1 [M] Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials

Reasoning with Equations & Inequalities

A.REI.1 Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

A.REI.4b Solve quadratic equations by inspection (e.g., for x2 = 49), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b.

QUADRATIC FUNCTIONS AND EQUATIONS

Why do we use different methods to solve math problems?

Chapter 9 MP 3 Weeks 6-9

BIG IDEAS

- Write expressions in equivalent forms to solve problems.
- Solve equations and inequalities in one variable.
- Solve systems of equations.
- Understand the concept of a function and use function notation.
- Interpret functions that arise in applications in terms of the context.
- Analyze functions using different representations.
- Build new functions from existing functions.
- Construct and compare linear, quadratic, and exponential models and solve problems.
- Summarize, represent, and interpret data on two categorical and quantitative variables
- Solve systems of equations.

ENDURING UNDERSTANDINGS

Seeing Structure in Expressions

A.SSE.3b Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.

Reasoning with Equations & Inequalities

A.REI.4 Solve quadratic equations in one variable.

A.REI.4b [M] Solve quadratic equations by inspection (e.g., for x2 = 49), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b.

A.REI.7 Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line y = –3x and the circle x2 + y2 = 3.

Interpreting Functions

F.IF.4 [M] For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity

F.IF.6 [M] Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.

F.IF.7a Graph linear and quadratic functions and show intercepts, maxima, and minima.

F.IF.7b Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

F.IF.8a Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.

Building Functions

F.BF.3 Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.

Linear, Quadratic, & Exponential Models

F.LE.1 Distinguish between situations that can be modeled with linear functions and with exponential functions.

F.LE.2 Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

Interpreting Categorical & Quantitative Data

S.ID.6a Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.

Reasoning with Equations & Inequalities

A.REI.7 Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line y = –3x and the circle x2 + y2 = 3.

RADICAL FUNCTIONS AND GEOMETRY

How can you choose a model to represent a real-world situation?

Chapter 10 MP 4 Weeks 1-2

BIG IDEAS

- Extend the properties of exponents to rational exponents.
- Use properties of rational and irrational numbers.
- Create equations that describe numbers or relationships.
- Solve equations and inequalities in one variable.
- Interpret functions that arise in applications in terms of the context.
- Analyze functions using different representations.
- Build new functions from existing functions.

ENDURING UNDERSTANDINGS

The Real Number System

N.RN.2 Rewrite expressions involving radicals and rational exponents using the properties of exponents.

N.RN.3 Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.

Creating Equations

A.CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

Reasoning with Equations & Inequalities

A.REI.4a [M] Use the method of completing the square to transform any quadratic equation in x into an equation of the form (x – p)2 = q that has the same solutions. Derive the quadratic formula from this form.

Interpreting Functions

F.IF.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity

F.IF.7b Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

Building Functions

F.BF.4a Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. For example, f(x) =2 x3 or f(x) = (x+1)/(x–1) for x ≠ 1.

RATIONAL FUNCTIONS AND EQUATIONS

How can simplifying mathematical expressions be useful?

Chapter 11 MP 4 Weeks 3-4

BIG IDEAS

- Create equations that describe numbers or relationships.
- Represent and solve equations and inequalities graphically.

ENDURING UNDERSTANDINGS

Creating Equations

A.CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

Reasoning with Equations & Inequalities

A.REI.11 Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.

STATISTICS AND PROBABILITY

How are statistics and probability used in the real world?

Chapter 12 MP 4 Weeks 6-8

BIG IDEAS

- Summarize, represent, and interpret data on a single count or measurement variable.
- Summarize, represent, and interpret data on two categorical and quantitative variables.

ENDURING UNDERSTANDINGS

Interpreting Categorical & Quantitative Data

S.ID.2 Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.

S.ID.3 Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

S.ID.5 Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.

EIGHTH GRADE
RESOURCE ROOM

Mathematics Emphasis in Grade 8

- Formulate the reason about expressions and equations, including modeling an association in bivariate data with a linear equation, and solving linear equations and systems of linear equations.
- Grasp the concept of a function and using functions to describe quantitative relationships.
- Analyze two- and three- dimensional space and figures using distance, angle, similarity, and congruence, and understand and apply the Pythagorean Theorem.

PARCC Grade Level Fluency Expectations

1. Analyze and solve linear equations and pairs of simultaneous linear equations.
   Expressions and Equations
   8.EE.7 Solve linear equations in one variable.

2. Solve real-world and mathematical problems involving volume of cylinders, cones and spheres.
   Geometry
   8.G.9 Know the formulas for the volume of cones, cylinders, and spheres and use them to solve real- world and mathematical problems.

Major Within Grade Dependencies

- An important development takes place in grade 8 when students make connections between proportional relationships, lines, and linear equations (8.EE, second cluster). Making these connections depends on prior grades' work, including 7.RP.2 and 6.EE.9. There is also a major dependency within grade 8 itself: The angle-angle criterion for triangle similarity underlies the fact that a nonvertical line in the coordinate plane has equation y = mx + b.[1] Therefore, students must do work with congruence and similarity (8.G.1-5) before they are able to justify the connections among proportional relationships, lines, and linear equations. Hence the indicated geometry work should likely begin at or near the very start of the year.

- Much of the work of grade 8 involves lines, linear equations, and linear functions (8.EE.5-8; 8.F.3-4; 8.SP.2-3). Irrational numbers, radicals, the Pythagorean theorem, and volume (8.NS.1-2; 8.EE.2; 8.G.6-9) are nonlinear in nature. Curriculum developers might choose to address linear and nonlinear bodies of content somewhat separately. An exception, however, might be that when addressing functions, pervasively treating linear functions as separate from nonlinear functions might obscure the concept of function per se. There should also be sufficient treatment of nonlinear functions to avoid giving students the misleading impression that all functional relationships are linear (see also 7.RP.2a).

RATIONAL NUMBERS

How do you use the arithmetic of rational numbers to solve equations?

Chapter 1 MP 1 Weeks 2-3

BIG IDEAS

- Know that there are numbers that are not rational, and approximate them by rational numbers.
- Analyze and solve linear equations and pairs of simultaneous linear equations.

ENDURING UNDERSTANDINGS

The Number System

8.NS.1	Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.
8.EE.7	Solve linear equations in one variable.
8.EE.7b	Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.

GRAPHS AND FUNCTIONS

How do you use functions to describe the relationship between two quantities?

Chapter 2 MP 1 Weeks 4-7

BIG IDEAS

- Define, evaluate, and compare functions.
- Use functions to model relationships between quantities.

ENDURING UNDERSTANDINGS

Functions

8.F.1 [M]	Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.
8.F.2	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.
8.F.4	Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.
8.F.5	Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

EXPONENTS AND ROOTS

What is the Pythagorean Theorem?

Chapter 3 MP 1 Weeks 8-11

BIG IDEAS

- Know that there are numbers that are not rational, and approximate them by rational numbers.
- Work with radicals and integer exponents.
- Understand and apply the Pythagorean Theorem.

ENDURING UNDERSTANDINGS

The Number System

8.NS.1 Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.

8.NS.2 Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π2). For example, by truncating the decimal expansion of $\sqrt{2}$, show that $\sqrt{2}$ is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.

Expressions and Equations

8.EE.1 [M] Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, $3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27$.

8.EE.2 [M] Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.

8.EE.3 [M] Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. For example, estimate the population of the United States as 3 times 10^8 and the population of the world as 7 times 10^9, and determine that the world population is more than 20 times larger.

8.EE.4[M] Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.

Geometry

8.G.6 [M] Explain a proof of the Pythagorean Theorem and its converse.

8.G.7 [M] Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.

8.G.8 [M] Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

RATIOS, PROPORTIONS, AND SIMILARITY

How can similar shapes be represented differently?

Chapter 4 MP 2 Weeks 1-3

BIG IDEAS

- Analyze proportional relationships and use them to solve real-world and mathematical problems.

ENDURING UNDERSTANDINGS

Geometry

8.G.3 [M] Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.

8.G.4 [M] Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.

GEOMETRIC RELATIONSHIPS

What is the relationship among angles?

Chapter 5 MP 2 Weeks 4-6

BIG IDEAS

- Understand congruence and similarity using physical models, transparencies, or geometry software.

ENDURING UNDERSTANDINGS

Geometry

8.G.1 [M] Verify experimentally the properties of rotations, reflections, and translations:

8.G.1a [M] Lines are taken to lines, and line segments to line segments of the same length.

8.G.1b [M] Angles are taken to angles of the same measure.

8.G.1c [M] Parallel lines are taken to parallel lines.

8.G.2 [M] Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.

8.G.3 Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.

8.G.4 Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.

8.G.5 [M] Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.

MEASUREMENT AND GEOMETRY

How do you calculate volume?

Chapter 6 MP 2 Weeks 9-10

BIG IDEAS

- Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.

ENDURING UNDERSTANDINGS

Geometry

8.G.9 Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

MULTI-STEP EQUATIONS

What strategies help to solve a system of equations?

Chapter 7 MP 3 Weeks 1-3

BIG IDEAS

- Analyze and solve linear equations and pairs of simultaneous linear equations.

ENDURING UNDERSTANDINGS

Career Education Integration

9.2.8.B.3 Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.

9.2.8.B.4 Evaluate how traditional and nontraditional careers have evolved regionally, nationally, and globally.

9.2.8.B.5 Analyze labor market trends using state and federal labor market information and other resources available online.

9.2.8.B.6 Demonstrate understanding of the necessary preparation and legal requirements to enter the workforce.

Connection: Students are expected to apply ration and proportions to real world situations – this can be applied to a variety of career choices. Students can create equations based upon different labor market trends and career path decisions.

Expressions and Equations

8.EE.7 [M] Solve linear equations in one variable.

8.EE.7a [M] Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers).

8.EE.7b [M] Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.

8.EE.8 [M] Analyze and solve pairs of simultaneous linear equations.

8.EE.8b [M] Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. For example, $3x + 2y = 5$ and $3x + 2y = 6$ have no solution because $3x + 2y$ cannot simultaneously be 5 and 6.

8.EE.8c [M] Solve real-world and mathematical problems leading to two linear equations in two variables. For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.

GRAPHING LINES

What is the slope of a line?

Chapter 8 MP 3 Weeks 4-6

BIG IDEAS

- 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.
- Use functions to model relationships between quantities.

ENDURING UNDERSTANDINGS

Expressions and Equations

8.EE.5 [M] Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.

8.EE.6 [M] Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation y = mx for a line through the origin and the equation y= mx + b for a line intercepting the vertical axis at *b*.

8.EE.8a [M] Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.

Functions

8.F.1 Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.

8.F.3 [M] Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.

8.F.4 Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.

8.F.5 Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

DATA, PREDICTION, AND LINEAR FUNCTIONS

What key questions can be answered using different data models?

Chapter 9 MP 4 Weeks 7-9

BIG IDEAS

- 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.
- Use functions to model relationships between quantities.
- Investigate patterns of association in bivariate data.

ENDURING UNDERSTANDINGS

Expressions and Equations

8.EE.5 Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.

Functions

8.F.1 Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.

8.F.2 [M] Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.

8.F.4 Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.

Statistics and Probability

8.SP.1 Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.

8.SP.2 Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.

8.SP.3 Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.

8.SP.4 Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?

Appendix A

Mathematical Practices

Mathematical Practices

1. Make sense of problems and persevere in solving them.

2. Reason abstractly and quantitatively.

3. Construct viable arguments and critique the reasoning of others.

4. Model with mathematics.

5. Use appropriate tools strategically.

6. Attend to precision.

7. Look for and make use of structure.

8. Look for and express regularity in repeated reasoning.

Appendix B

PARCC Mastery Standards

Grades 3 - 8 Cluster Emphasis

3rd Grade	4th Grade	5th Grade	6th Grade	7th Grade	8th Grade
3.OA.1 - M	4.OA.1 - M	5.OA.1 - A	6.RP.1 - M	7.RP.1 - M	8.NS.1 - S
3.OA.2 - M	4.OA.2 - M	5.OA.2 - A	6.RP.2 - M	7.RP.2a - M	8.NS.2 - S
3.OA.3 - M	4.OA.3 - M	5.OA.3 - A	6.RP.3a - M	7.RP.2b - M	8.EE.1 - M
3.OA.4 - M	4.OA.4 - S	5.NBT.1 - M	6.RP.3b - M	7.RP.2c - M	8.EE.2 - M
3.OA.5 - M	4.OA.5 - A	5.NBT.2 - M	6.RP.3c - M	7.RP.2d - M	8.EE.3 - M
3.OA.6 - M	4.NBT.1- M	5.NBT.3a - M	6.RP.3d - M	7.RP.3 - M	8.EE.4 - M
3.OA.7 - M	4.NBT.2 - M	5.NBT.3b - M	6.NS.1 - M	7.NS.1a - M	8.EE.5 - M
3.OA.8 - M	4.NBT.3 - M	5.NBT.4 - M	6.NS.2 - A	7.NS.1b - M	8.EE.6 - M
3.OA.9 - M	4.NBT.4 - M	5.NBT.5 - M	6.NS.3 - A	7.NS.1c - M	8.EE.7a - M
3.NBT.1 - A	4.NBT.5 - M	5.NBT.6 - M	6.NS.4 - A	7.NS.1d - M	8.EE.7b - M
3.NBT.2 - A	4.NBT.6 - M	5.NBT.7 - M	6.NS.5 - M	7.NS.2a - M	8.EE.8a - M
3.NBT.3 - A	4.NF.1 - M	5.NF.1 - M	6.NS.6a - M	7.NS.2b - M	8.EE.8b - M
3.NF.1 - M	4.NF.2 - M	5.NF.2 - M	6.NS.6b - M	7.NS.2c - M	8.EE.8c - M
3.NF.2a - M	4.NF.3a - M	5.NF.3 - M	6.NS.6c - M	7.NS.2d - M	8.F.1 - M
3.NF.2b - M	4.NF.3b - M	5.NF.4a - M	6.NS.7a - M	7.NS.3 - M	8.F.2 - M
3.NF.3a - M	4.NF.3c - M	5.NF.4b - M	6.NS.7b - M	7.EE.1 - M	8.F.3 - M
3.NF.3b - M	4.NF.3d - M	5.NF.5a - M	6.NS.7c - M	7.EE.2 - M	8.F.4 - S
3.NF.3c - M	4.NF.4a - M	5.NF.5b - M	6.NS.7d - M	7.EE.3 - M	8.F.5 - S
3.NF.3d - M	4.NF.4b - M	5.NF.6 - M	6.NS.8 - M	7.EE.4a - M	8.G.1a - M
3.MD.1 - M	4.NF.4c - M	5.NF.7a - M	6.EE.1 - M	7.EE.4b - M	8.G.1b - M
3.MD.2 - M	4.NF.5 - M	5.NF.7b - M	6.EE.2a - M	7.G.1 - A	8.G.1c - M
3.MD.3 - S	4.NF.6 - M	5.NF.7c - M	6.EE.2b - M	7.G.2 - A	8.G.2 - M
3.MD.4 - S	4.NF.7 - M	5.MD.1 - S	6.EE.2c - M	7.G.3 - A	8.G.3 - M
3.MD.5a - M	4.MD.1 - S	5.MD.2 - S	6.EE.3 - M	7.G.4 - A	8.G.4 - M
3.MD.5b - M	4.MD.2 - S	5.MD.3a - M	6.EE.4 - M	7.G.5 - A	8.G.5 - M
3.MD.6 - M	4.MD.3 - S	5.MD.3b - M	6.EE.5 - M	7.G.6 - A	8.G.6 - M
3.MD.7a - M	4.MD.4 - S	5.MD.4 - M	6.EE.6 - M	7.SP.1 - S	8.G.7 - M
3.MD.7b - M	4.MD.5a - A	5.MD.5a - M	6.EE.7 - M	7.SP.2 - S	8.G.8 - M
3.MD.7c - M	4.MD.5b - A	5.MD.5b - M	6.EE.8 - M	7.SP.3 - A	8.G.9 - A
3.MD.7d - M	4.MD.6 - A	5.MD.5c - M	6.EE.9 - M	7.SP.4 - A	8.SP.1 - S
3.MD.8 - A	4.MD.7 - A	5.G.1 - A	6.G.1 - S	7.SP.5 - S	8.SP.2 - S
3.G.1 - S	4G.1 - A	5.G.2 - A	6.G.2 - S	7.SP.6 - S	8.SP.3 - S
3.G.2 - S	4G.2 - A	5.G.3 - A	6.G.3 - S	7.SP.7a - S	8.SP.4 - S
	4G.3 - A	5.G.4 - A	6.G.4 - S	7.SP.7b - S	
			6.SP.1 - A	7.SP.8a - S	
			6.SP.2 - A	7.SP.8b - S	
			6.SP.3 - A	7.SP.8c - S	
			6.SP.4 - A		
			6.SP.5a - A		
			6.SP.5b - A		
			6.SP.5c - A		
			6.SP.5d - A		

M Major Content S Supporting Content A Additional Content

Critical Areas Kindergarten through Algebra II

Kindergarten (1) represent, relating, and operating on whole numbers, initially with sets of objects (2) describe shapes and space More learning time in Kindergarten should be devoted to number than to other topics	**1st Grade** (1) develop an understanding of addition, subtraction, and strategies for addition and subtraction within 20 (2) develop an understanding of whole number relationships and place value, including grouping in tens and ones (3) develop an understanding of linear measurement and measuring lengths as iterating length units (4) reason about attributes of, and compose and decompose geometric shapes	**2nd Grade** (1) extend understanding of base-ten notation (2) build fluency with addition and subtraction (3) use standard units of measure (4) describe and analyze shapes
3rd Grade (1) develop an understanding of multiplication and division and strategies for multiplication and division within 100 (2) develop an understanding of fractions, especially unit fractions (fractions with numerator 1) (3) develop an understanding of the structure of rectangular arrays and of area (4) describe and analyze two-dimensional shapes	**4th Grade** (1) develop an understanding and fluency with multi-digit multiplication, and develop an understanding of dividing to find quotients involving multi-digit dividends (2) develop an understanding of fraction equivalence, addition and subtraction of fractions with like denominators, and multiplication of fractions by whole numbers (3) understand that geometric figures can be analyzed and classified based on their properties, such as having parallel sides, perpendicular sides, particular angle measures, and symmetry	**5th Grade** (1) develop fluency with addition and subtraction of fractions, and develop an understanding of the multiplication of fractions and of division of fractions in limited cases (unit fractions divided by whole numbers and whole numbers divided by unit fractions) (2) extend division to 2-digit divisors, integrate decimal fractions into the place value system and develop understanding of operations with decimals to hundredths, and develop fluency with whole number and decimal operations (3) develop an understanding of volume
6th Grade (1) connect ratio and rate to whole number multiplication and division and use concepts of ratio and rate to solve problems (2) complete understanding of division of fractions and extend the notion of number to the system of rational numbers, which includes negative numbers (3) write, interpret, and use expressions and equations (4) develop an understanding of statistical thinking	**7th Grade** (1) develop an understanding of and apply proportional relationships (2) develop an understanding of operations with rational numbers and work with expressions and linear equations (3) solve problems involving scale drawings and informal geometric constructions, and work with two- and three-dimensional shapes to solve problems involving area, surface area, and volume (4) draw inferences about populations based on samples	**8th Grade** (1) formulate and reason about expressions and equations, including modeling an association in bivariate data with a linear equation, and solving linear equations and systems of linear equations (2) grasp the concept of a function and using functions to describe quantitative relationships (3) analyze two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and understand and apply the Pythagorean Theorem
Algebra I (1) relationships between quantities and reasoning with equations (2) linear and exponential relationships (3) descriptive statistics (4) expressions and equations (5) quadratic functions and modeling	**Geometry** (1) congruence, proof, and constructions (2) similarity, proof, and trigonometry (3) extending to three dimensions (4) connecting algebra and geometry through coordinates (5) circles with and without coordinates (6) applications of probability	**Algebra II** (1) polynomial, rational, and radical relationships (2) trigonometric functions (3) modeling with functions (4) connecting algebra and geometry through inferences and conclusions from data

Fluency Expectations/Recommendations and Examples of Culminating Standards Kindergarten through Algebra II

Kindergarten • Add and subtract within 5 (K.OA.5) (fluency)	**1st Grade** • Add and subtract within 10 (1.OA.6) (fluency)	**2nd Grade** • Add and subtract within 20 using mental strategies (2.OA.2) (fluency) • Know sums of 2 one-digit numbers by memory (2.OA.2) (fluency) • Add and subtract within 100 (2.NBT.5) (fluency)
3rd Grade • Multiply and divide within 100 (3.OA.7) (fluency) • Know products of two-digit numbers from memory (3.OA.7) (fluency) • Add and subtract within 1000 (3.NBT.2) (fluency)	**4th Grade** • Add and subtract multi-digit whole numbers (4.NBT.4) (fluency) • Add and subtract within 1,000,000 (4.NBT.4) (fluency)	**5th Grade** • Multiply multi-digit whole numbers (5.NBT.5) (fluency)
6th Grade • Divide multi-digit whole numbers (6.NS.2) (fluency/culminating) • Add, subtract, multiply, and divide multi-digit decimals (6.NS.3) (fluency/culminating) • Divide fractions (6.NS.1) (culminating)	**7th Grade** • Add, subtract, multiply, and divide rational numbers (7.NS.1-2) (culminating) • Solve multi-step problems with positive and negative rational numbers (7.EE.3) (culminating) • Solve equations $px+q=r$ and $p(x+q)=r$ (7.EE.4) (culminating)	**8th Grade** • Solutions of one-variable linear equations where coefficients may be rational (8.EE.7) (culminating) • Set of geometric measurement skills (volume of cones, cylinders, and spheres-includes 7th grade work in angle measure, area, surface area and volume) (8.G.9) (culminating)
Algebra I • Analytic geometry of lines (A/G) (fluency recommendation) • Add, subtract, and multiply polynomials (A-APR.1) (fluency recommendation) • Transforming expressions and "chunking" (seeing parts of an expression as a single object) (A-SSE.1b) (fluency recommendation)	**Geometry** • Triangle congruence and similarity criteria (G-SRT.5) (fluency recommendation) • Use coordinates to establish geometric results (G-GPE.4, 5, 7) (fluency recommendation) • Use construction tools (G-CO.12) (fluency recommendation)	**Algebra II** • Divide polynomials with remainders by inspection in simple cases (A-APR.6) (fluency recommendation) • Rewrite expressions (A-SSE.2) (fluency recommendation) • Translate between recursive definitions and closed forms (F-IF.3) (fluency recommendation)

Appendix C

Materials and Assessments

MATHEMATICS

TEXTBOOKS

Grade 6-8 general & resource course: *Holt Mathematics Common Core*, 2012, Holt McDougal
Grade 8: *Algebra I Common Core*, 2012, Houghton-Mifflin
Grade 6 honors course: *Holt Mathematics Common Core*, 2012, Holt McDougal
Grade 7 honors course: *Glencoe Math Accelerated 7*, Glencoe/McGraw-Hill, 2014
Grade 8 honors course: *Algebra I*, Glencoe/McGraw-Hill, 2014

SUPPLEMENTAL MATERIALS AND RESOURCES

Math Test Specifications Documents and Evidence Statements
http://parcc-assessment.org/assessments/test-design/mathematics/math-test-specifications-documents
Bellringers PARCC prep
BrainPOP
Flocabulary
Goalbook Pathways, Goalbook
SMARTBoard applications
ALEKS online program
PARCC Made Easy, American Book Company
TenMarks online program

MANIPULATIVES:

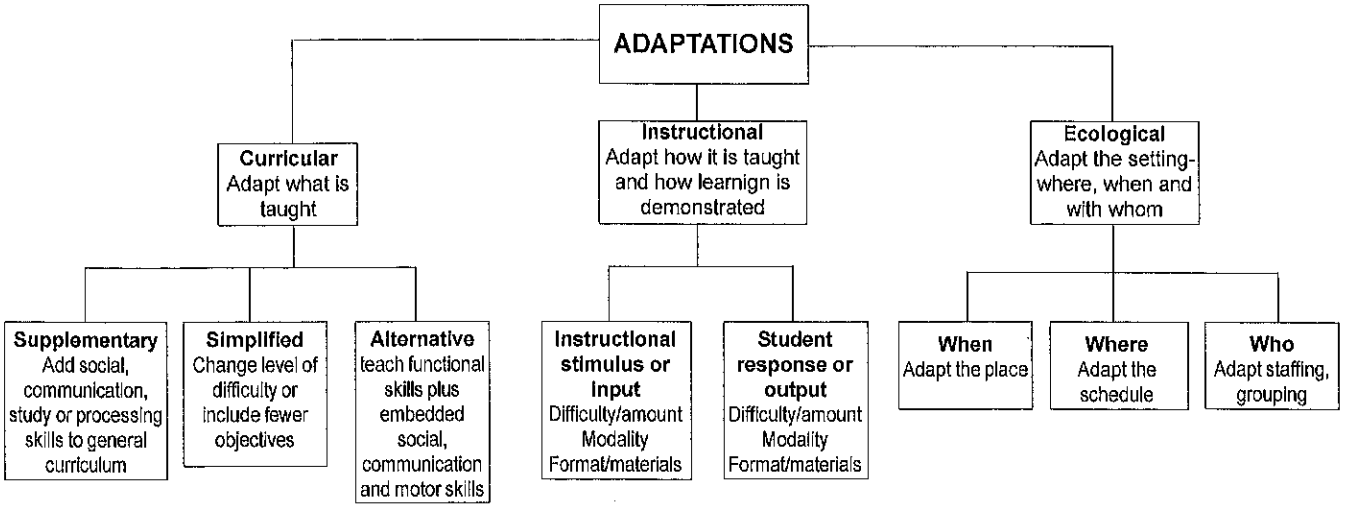
Pattern Blocks	Individual White Boards
Graphing Calculators	Protractors
Calculators	Compasses
Base-ten blocks	Cuisenaire Rods
Snap cubes	Tesselation Packs
Two-color counters	Rulers
Number cubes	Volume Relationship sets
Dice	Spinners
Clock dials	Mirrors
Flash cards	Number Cards and Polyhedra
Money	Geoboards
Fraction Circles	Tangrams
Color tiles 3-D	Wood Figures

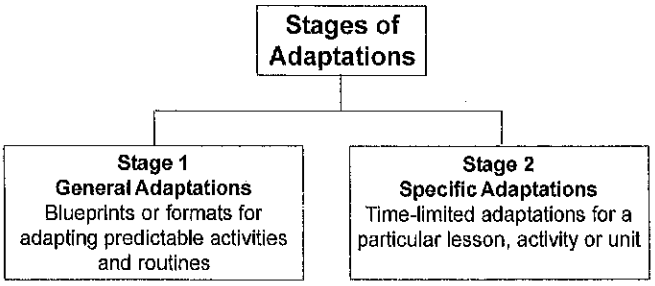
ACTIVITIES:	ASSESSMENTS:
Modeling	Formative and Summative Tests and Quizzes
Discussion	Oral questions and answers
Journaling	Constructive Response Questions
Projects	Projects
Cooperative Group Work	Participation in Group Work
Problem Solving and Calculator Use	Teacher Observation, Classwork, Homework

Appendix D

Modifications

ESL
Special Education
Gifted and Talented
At-Risk


ADAPTATIONS
Curricular
Adapt what is taught
Instructional
Adapt how it is taught and how learnign is demonstrated
Ecological
Adapt the setting-where, when and with whom
Supplementary
Add social, communication, study or processing skills to general curriculum
Simplified
Change level of difficulty or include fewer objectives
Alternative
teach functional skills plus embedded social, communication and motor skills
Instructional stimulus or input
Difficulty/amount
Modality
Format/materials
Student response or output
Difficulty/amount
Modality
Format/materials
When
Adapt the place
Where
Adapt the schedule
Who
Adapt staffing, grouping


Stages of Adaptations
Stage 1
General Adaptations
Blueprints or formats for adapting predictable activities and routines
Stage 2
Specific Adaptations
Time-limited adaptations for a particular lesson, activity or unit

At-Risk Accommodations for Classroom Interventions ___Tier 1 ___Tier 2

Name _____ Teacher _____ Begin Date _____

Evaluation Date (6 weeks): _____ Continue? Yes No (if No, move to next Tier)

Pacing

___ Adjust time for completion of assignments
___ Allow frequent breaks, vary activities often
___ Modify assignments requiring copying in a timed situation
___Other:_____
_____
_____

Environment

___ Leave class for assistance
___ Preferential seating
___ Define limits (behavioral/physical)
___ Reduce/minimize distractions
visual _____ auditory _____
___ Cooling off period
___ Provide consistent structure
___ Adjust lighting
___ Adjust room temperature
___ Other:_____
_____
_____

Presentation of Subject Matter

___ Emphasize teaching
___ auditory ___ visual
___ tactile ___ multi
___ Individual/small group instruction
___ Utilize specialized curriculum
___ Tape lectures for replay
___ Present demonstration
___ Utilize manipulatives
___ Emphasize critical information/key concepts
___ Pre-teach vocabulary
___ Provide visual cues
___ Provide study guide or note cards or notes
___ Other: _____

Modification Legend:

S-Successful **U-Unsuccessful**

Assignments

___ Modify homework (Specify.)_____
___ Give directions in small units
___ Use written backup for oral directions
___ Lower reading level of assignment (RL=__)
___ Adjust length of assignment
___ Change format of assignment
___ Break assignment into a series of smaller assignments
___ Reduce paper and pencil tasks
___ Read directions/worksheets to student
___ Record or type assignments
___ Maintain assignment notebook
___ Avoid penalizing for spelling errors
___ Block off or mask sections of work
___ Use highlighted texts
___ Use taped texts
___ Use computer
___ Use calculator
___ Student planner
___ Other:_____

Reinforcement and Motivations

___ Use positive reinforcement
___ Use concrete reinforcers
___ Check often for understanding/review
___ Peer tutoring
___ Request parent-reinforcement
___ Have student repeat directions
___ Emphasize study/organizational skills
___ Repeated review/drill
___ Use behavior modification techniques
___ Before or after school tutoring
___ Emphasize socialization skills
___ Other: _____

Testing Adaptations

___ Oral tests ___ Bundling
___ Taped tests ___ Modified format
___ Large print ___ Content Mastery
___ Other: _____

ESL CURRICULUM MODIFICATIONS

Instruction

Tip: ESL students need modified instruction to learn both English and content.

Modifying instruction is critical to ESL students' success. However, modifying instruction doesn't mean creating a second lesson plan or curriculum; it just means changing some of the ways you do things. Most of your native English-speaking students can benefit from modifications as well.

Technique: Use various teaching styles and tricks of the trade.

- Teach to varied learning styles
- Encourage students to participate in class
- Have high expectations of your students
- Give students more wait time: at least 15-20 seconds
- Assign students a bilingual or English-speaking study buddy
- Use cooperative learning and put students in groups with English-speaking students
- Use lots of visuals, like graphic organizers and pictures
- Use physical activity: model, role-play, act out
- Repeat and rephrase often
- Emphasize the 5-8 most important vocabulary words of a lesson
- Focus on the 2-3 key concepts of a lesson
- Give students an outline of the lesson that highlights the key concepts
- Let ESL students copy your or someone else's notes
- Write in print unless specifically teaching the manuscript alphabet
- Give simple instructions
- Use concrete language and questions
- Simplify complex questions
- Use children's literature/lower grade level materials to teach content
- Incorporate the 4 skills of language acquisition: reading/writing/listening/speaking
- Check understanding using "show me" techniques

Class/Homework

Tip: ESL students experience greater success when class-work and homework is modified to fit their capabilities.

Modifying class-work or homework tasks to fit ESL students' capabilities doesn't mean expecting less from them. It means giving them realistic tasks to complete that increase their chances for success.

Technique: Allow for flexibility in the tasks you assign.

- Reduce assignments
- Simplify complex tasks
- Give ESL students extra time to do work or complete projects
- Adapt the task to the students' skill levels
- Ignore spelling or grammar errors except for when explicitly taught
- Allow students to take breaks when working: their brains tire quickly!

Assessment Modifications

Tip: Assess ESL students according to what they can do rather than what they cannot do.

Standardized tests or even teacher-created tests can't always measure ESL students' progress accurately or authentically. Instead, measure ESL students by what they can do at any point in time, keeping in mind what they could not do earlier. Have they shown progress? Have they sincerely made an effort to learn? Have they demonstrated their learning?

Technique: Modify the tests you give.

- Test key concepts or main ideas
- Avoid test questions asking for discrete information
- Make a simplified language version of the test
- Simplify instructions
- Provide word banks
- Give students extra time to complete tests
- Give students objective tests: matching, multiple choice, etc.
- Make all or part of the exam oral.

Technique: Use alternate assessment strategies for ESL students.

1. Non-Verbal
   - physical demonstration (point, gesture, act out, thumbs up/down, nod yes/no)
   - pictorial products (manipulate or create drawings, diagrams, dioramas, models, graphs, charts; label pictures; keep a picture journal
   - KWL Charts using pictures or native language

2. Oral and Written Strategies
   - interviews, oral reports, role plays using visuals cues, gestures or physical activity
   - describing, explaining, summarizing, retelling, paraphrasing
   - thinking and learning logs
   - reading response logs
   - writing assignments
   - dialogue journals
   - audio or video recordings of students
   - portfolios

Source: Harleys-ESL-Modifications

GIFTED AND TALENTED CURRICULUM MODIFICATIONS

Berger, S.
ERIC Digest
#E510

This article by Sandra L. Berger discusses how gifted students "need an appropriately differentiated curriculum designed to address their individual characteristics, needs, abilities, and interests. It is difficult to generalize about students who are gifted because their characteristics and needs are so personal and unique. However, as a group they comprehend complex ideas quickly, learn more rapidly and in greater depth than their age peers, and may exhibit interests that differ from those of their peers. They need time for in-depth exploration, they manipulate ideas and draw generalizations about seemingly unconnected concepts, and they ask provocative questions."

Developing An Effective Curriculum

An effective curriculum for students who are gifted is essentially a basic curriculum that has been modified to meet their needs. The unique characteristics of the students must serve as the basis for decisions on how the curriculum should be modified (Feldhusen, Hansen, & Kennedy, 1989; Maker 1982; TAG, 1989; VanTassel-Baska et al., 1988). It results from appropriate modification of content, process, environment, and product (Maker, 1982).

Modifying Content

Content consists of ideas, concepts, descriptive information, and facts. Content, as well as learning experiences, can be modified through acceleration, compacting, variety, reorganization, flexible pacing, and the use of more advanced or complex concepts, abstractions, and materials. When possible, students should be encouraged to move through content areas at their own pace. If they master a particular unit, they need to be provided with more advanced learning activities, not more of the same activity. Their learning characteristics are best served by thematic, broad-based, and integrative content, rather than just single-subject areas. An entire content area arranged and structured around a conceptual framework can be mastered in much less time than is traditionally allotted (VanTassel-Baska, 1989). In addition, such concept-based instruction expands opportunities to generalize and to integrate and apply ideas. (See Bruner, 1966, MAN: A COURSE OF STUDY MACOS for an example of a thematic, integrated curriculum.)

Middle and secondary schools are generally organized to meet student needs within content areas. Providing an interdisciplinary approach is another way of modifying curriculum . Jacobs and Borland (1986) found that gifted students benefit greatly from curriculum experiences that cross or go beyond traditional content areas, particularly when they are encouraged to acquire an integrated understanding of knowledge and the structure of the disciplines.

Modifying Process

To modify process, activities must be restructured to be more intellectually demanding. For example, students need to be challenged by questions that require a higher level of response or by open-ended questions that stimulate inquiry, active exploration, and discovery. Although instructional strategies depend on the age of the students and the nature of the disciplines involved, the goal is always to encourage students to think about subjects in more abstract and complex ways. Activity selection should be based on student interests, and activities should be used in ways that encourage self-directed learning. Bloom's TAXONOMY OF EDUCATIONAL OBJECTIVES (1956) offers the most common approach to process modification. His classification system moves from more basic levels of thought, such as memory or recall, to more complex levels of analysis, synthesis, and evaluation. Parnes (1966), Taba (1962), and others have provided additional models for structuring thinking skills. Every teacher should know a variety of ways to stimulate and encourage higher level thinking skills. Group interaction and

simulations, flexible pacing, and guided self-management are a few of the methods for managing class activities that support process modification.

Modifying Environment

Gifted students learn best in a receptive, nonjudgmental, student-centered environment that encourages inquiry and independence, includes a wide variety of materials, provides some physical movement, is generally complex, and connects the school experience with the greater world. Although all students might appreciate such an environment, for students who are gifted it is essential that the teacher establish a climate that encourages them to question, exercise independence, and use their creativity in order to be all that they can be.

Modifying Product Expectation and Student Response

Teachers can encourage students to demonstrate what they have learned in a wide variety of forms that reflect both knowledge and the ability to manipulate ideas. For example, instead of giving a written or oral book report, students might prefer to design a game around the theme and characters of a book. Products can be consistent with each student's preferred learning style. They should address real problems, concerns, and audiences; synthesize rather than summarize information; and include a self-evaluation process.

Assessing Curriculum Effectiveness

In their synthesis of curriculum effectiveness studies and effective practice, VanTassel-Baska et al. (1988) suggested that differentiated curriculum would respond to diverse characteristics of gifted learners in the following three ways:

- By accelerating the mastery of basic skills through testing-out procedures and reorganization of the curriculum according to higher level skills and concepts.
- By engaging students in active problem-finding and problem-solving activities and research.
- By providing students opportunities for making connections within and across systems of knowledge by focusing on issues, themes, and ideas.

Curriculum development is a dynamic, ongoing process. Special attention needs to be paid to articulation, scope, and sequence to avoid gaps and repetition through grade levels; ensure that the understandings and skills we expect children to develop fit together; and assure that children are provided with the knowledge and skills that will prepare them for the future. Periodic evaluations of curriculum effectiveness allow corrections to be made when needed, and they are essential if curriculum is to meet the long-term needs of gifted students for increasingly complex and challenging opportunities.

Conclusion

The curriculum committee of the Leadership Training Institute (Passow, 1982) developed seven guiding principles for curriculum differentiation that reflect the considerations described in this Digest.

- The content of curricula for gifted students should focus on and be organized to include more elaborate, complex, and in-depth study of major ideas, problems, and themes that integrate knowledge within and across systems of thought.
- Curricula for gifted students should allow for the development and application of productive thinking skills to enable students to reconceptualize existing knowledge and/or generate new knowledge.
- Curricula for gifted students should enable them to explore constantly changing knowledge and information and develop the attitude that knowledge is worth pursuing in an open world.
- Curricula for gifted students should encourage exposure to, selection, and use of appropriate and specialized resources.
- Curricula for gifted students should promote self-initiated and self-directed learning and growth.

- Curricula for gifted students should provide for the development of self-understanding and the understanding of one's relationship to persons, societal institutions, nature, and culture.
- Evaluations of curricula for gifted students should be conducted in accordance with the previously stated principles, stressing higher level thinking skills, creativity, and excellence in performance and products.
- Developing curriculum that is sufficiently rigorous, challenging, and coherent for students who are gifted is a challenging task. The result, however, is well worth the effort. Appropriately differentiated curriculum produces well-educated, knowledgeable students who have had to work very hard, have mastered a substantial body of knowledge, and can think clearly and critically about that knowledge. Achieving such results for one or for a classroom full of students who are gifted will produce high levels of satisfaction, not only for the students who are beneficiaries, but also for every teacher who is willing to undertake the task.

Credits

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The Council for Exceptional Children, ERIC Clearinghouse on Handicapped and Gifted Children, Reston, Va.

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Permission Statement

Comments

Contributed by: DITD Team Member on 3/29/2005
This is a very good article for teachers and parents. It lists all of the positives of differentiating curriculum in schools. It is short and to the point.

SPECIAL EDUCATION CURRICULUM MODIFICATIONS

The New Jersey Council on Developmental Disabilities has compiled the "Tools for Teachers" to provide basic information and guidance in demonstrated best practice strategies for including students with disabilities in general education settings. Developed by the Council's Subcommittee on Education the follow excerpt from Park 2 Curriculum Modifications and Adaptations provides guidance in meeting the needs of special education students in the general curriculum.

The New Jersey Council on Developmental Disabilities' Education Task Force has complied "Tools for Teachers" to provide basic information and guidance in demonstrated best practice strategies for including students with disabilities in general education settings.

CURRICULUM MODIFICATIONS & ADAPTATIONS

There is no recipe for adapting general education curriculum to meet each student's needs. Each teacher, each student, each classroom is unique and adaptations are specific to each situation. Keep in mind that curriculum does not always need to be modified. By providing multi-level instruction you will find that adapting a lesson may not always be necessary. Differentiating instruction and providing multiple ways assess allows more flexibility for students to meet the standards and requirements of the class. At other times, the curriculum can be made more accessible through accommodations. In addition, supports for one student may not necessarily be the same in all situations, e.g., a student who needs full time support from a paraprofessional for math may only need natural supports from peers for English, and no support for art. And, supports should not be determined by the disability label; instead supports should be used when the instructional or social activity warrants the need for assistance. (Fisher and Frey, 2001).

The forms and examples on the following pages provide information about curriculum and types of adaptations that could be considered in developing the appropriate strategy for a particular student.

A Curricular Adaptation and Decision-making Process

This decision-making flowchart can be used to conceptualize the process of selecting and implementing curricular adaptations. It should be used as a tool for a team in determining an individual student's needs.

Identify the student's individual educational goals and objectives to be emphasized during general education activities

Articulate the expectations for the student's performance in general education activities

Determine what to teach As a team, determine the content of the general education activity, theme or unit study

Determine how to teach As a team, determine if, without modification, the student can actively participate and achieve the same essential outcomes as non-disabled classmates. If the student cannot achieve the same outcomes...

Select of design appropriate adaptations

Select instructional arrangement	Select lesson format	Employ student-specific teaching strategies	Select curricular goals specific to the lesson	Engineer the physical and social classroom environment	Design modified materials	Select natural supports and supervision arrangements

If the above adaptation strategies are not effective, design an alternative activity

Evaluate effectiveness of adaptations

A Curricular Adaptation and Decision-making Model

Examine the Structure of the Instruction

1. Can the student actively participate in the lesson without modification? Will the same essential outcome he achieved?
2. Can the student's participation he increased by changing the instructional arrangement?

From traditional arrangements to:

- Cooperative groups
- Small groups
- Peer partners
- Peer or cross-age tutors

3. Can the student's participation be increased by changing the lesson format?
   - Interdisciplinary/thematic units
   - Activity-based lessons, games, simulations, role-plays
   - Group investigation or discovery learning
   - Experiential lessons
   - Community-referenced lessons
4. Can the Student's participation and understanding be increased by changing the delivery of instruction or teaching style?

Examine the Demands and Evaluation Criteria of the Task

5. Will the student need adapted curricular goals?
   - Adjust performance standards
   - Adjust pacing
   - Same content but less complex
   - Similar content with functional/direct applications
   - Adjust the evaluation criteria or system (grading)
   - Adjust management techniques

Examine the Learning Environment

6. Can the changes he made in the classroom environment or lesson location that will facilitate participation?
   - Environmental/physical arrangements
   - Social rules
   - Lesson location

Examine the Materials for Learning

7. Will different materials be needed to ensure participation?
   - Same content but variation in size, number, format
   - Additional or different materials/devices
   - Materials that allow a different mode of input
   - Materials that allow a different mode of output
   - Materials that reduce the level of abstraction of information

Examine the Support Structure

8. Will personal assistance be needed to ensure participation?
   - From peers or the general education instructor?
   - From the support facilitator'?
   - From therapists'?
   - From paraprofessionals?
   - From others?

Arrange Alternative Activities that Foster Participation and Interaction

9. Will a different activity need to be designed and offered for the student and a small group of peers?
   - In the classroom
   - ln other general education environments
   - In community-based environments

Curriculum Adaptations

It is important to correlate adaptations with the IEP. In other words, we are not adapting for adaptations sake but, to meet the student's needs as identified on an IEP.

a. Curriculum as is. This is the type we forget most frequently. We need to constantly be looking at the general education curriculum and asking if the students on IEPs may gain benefit from participating in the curriculum as is. We need to keep in mind that incidental learning does occur. Curriculum as is supports outcomes as identified in standard curriculum.

Move in this direction only when necessary

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b. Different objective within the same activity and curriculum. The student with an
IEP works with all the other students in the classroom participating in the activity when possible but, with a different learning objective from the other students. This is where the principle of partial participation fits. Examples include.

- A student with a short attention span staying on task for 5 minutes.
- Using a switch to activate a communication device to share during a class discussion.
- Expressing one's thoughts by drawing in a journal instead of writing.
- Holding a book during reading time.
- Understanding the effect World War II has on the present rather than knowing the
- names and dates of key battles.

---

c. Material or environmental adaptations. The material or environmental changes are utilized so that participation in the general education curriculum by the student with the IEP may occur. Examples include:

- 5 spelling words from the weekly list instead of the standard 20.
- Completing a cooking assignment by following picture directions rather than written
- directions
- Changing the grouping of the class from large group to small groups (possible with the
- additional support staff).
- Changing the instructional delivery from lecture to the cooperative learning format
- Using a computer to write an assignment instead of paper and pencil.
- Reading a test to a student.
- Highlighting the important concepts in a textbook.
- Having the student listen to a taped textbook.
- Using enlarged print
- Using an assistive technology device
- Using visual cues such as picture and/or word schedules for those who have difficulty staying on task.
- Using a note taking guide listing the key concepts during a lecture.

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d. Providing Physical assistance. Assistance from another person may be needed for a student to participate in a classroom activity. If possible, it is better to use natural supports (peers) as these will be the people always present in the student' life. If the use of peers is not possible, then the support teacher, the paraprofessional, the classroom teacher, the classroom aide, or a parent volunteer

may provide the assistance. Most peers and staff will need training in the correct way of providing physical assistance. In addition, we need to keep in mind the principle of partial participations. Examples include: • Starting a computer for a student with an IEP to use. • Guiding a hand during handwriting. • Assisting in activating a switch. • Completing most of the steps of an activity and having a student with an IEP do the remainder • Pushing a student in a wheelchair to the next activity. _____ **e. Alternative/substitute curriculum.** This is sometimes referred to as functional curriculum as it usually involves the acquisition of "life skills." The decision to use alternative/substitute curriculum is a major change and needs to be reflected on the IEP. This decision should be carefully made after weighing all of the pros and cons of using an alternative curriculum. The alternative curriculum may or may not take place in the general education classroom. Examples include: • Community-based instruction (which all students may benefit from!) • Learning job skills in the school cafeteria. • Learning how to use a communication device. • Doing laundry for the athletic department • Learning cooking/grooming skills at the home.	

Overlap does occur among the five types of curriculum adaptations

Nine Types of Adaptations

Input	**Output**	**Time**
Adapt the way instruction is delivered to the learner. *For example:* Use different visual aids; plan more concrete examples; provide hands-on activities; place students in cooperative groups	Adapt how the learner can respond to instruction *For example:* Allow a verbal vs. written response; use a communication book for students; allow students to show knowledge with hands-on materials.	Adapt the time allotted and allowed for learning, task completion or testing. *For example:* Individualize a timeline for completing a task; pace learning differently (increase or decrease) for some learners

Difficulty	**Level of Support**	**Size**
Adapt the skill level, problem type, or the rules on how the learner may approach the work. *For example:* Allow a calculator for math problems; simplify task directions; change rules to accommodate learner needs.	Increase the amount of personal assistance with specific learner. *For example:* Assign peer buddies, teaching assistants, peer tutors or cross-age tutors	Adapt the number of items that the learner is expected to learn or compete. *For example:* Reduce the number of social studies terms a learner must learn at any one time.

Degree of Participation	**Alternate Goals**	**Substitute Curriculum**
Adapt the extent to which a learner is actively involved in the task. *For example:* In geography, have a student hold the globe, while others point out the locations.	Adapt the goals or outcome expectations while using the same materials. *For example:* In social studies, expect one student to be able to locate just the states while others learn to locate capitals as well.	Provide the different instruction and materials to meet a learner's individual goals. *For example:* Individualize a timeline for completing a task; pace learning differently (increase or decrease) for some learners.