New Hanover Township School

Grade: Algebra I (8th grade)

Content Area: Mathematics

Chapter 1

Domain: Quantities and Seeing Structure in Expressions

Common Core Standards

Quantities

CCSS.Math.Content.HSN-Q.A.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.

CCSS.Math.Content.HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling.

CCSS.Math.Content.HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

Seeing Structure in Expressions

CCSS.Math.Content.HSA-SSE.A.1 Interpret expressions that represent a quantity in terms of its context.★

CCSS.Math.Content.HSA-SSE.A.1a Interpret parts of an expression, such as terms, factors, and coefficients.

CCSS.Math.Content.HSA-SSE.A.1b 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.*

CCSS.Math.Content.HSA-SSE.A.2 Use the structure of an expression to identify ways to rewrite it. *For example, see* $x^4 - y^4$ *as* $(x^2)^2 - (y^2)^2$*, thus recognizing it as a difference of squares that can be factored as* $(x^2 - y^2)(x^2 + y^2)$.

CCSS.Math.Content.HSA-SSE.B.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.★

CCSS.Math.Content.HSA-SSE.B.3a Factor a quadratic expression to reveal the zeros of the function it defines.

CCSS.Math.Content.HSA-SSE.B.3b Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.

CCSS.Math.Content.HSA-SSE.B.3c Use the properties of exponents to transform expressions for exponential functions. *For example the expression* 1.15^t *can be rewritten as* $(1.15^{1/12})^{12t} \approx 1.012^{12t}$ *to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.*

CCSS.Math.Content.HSA-SSE.B.4 Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. *For example, calculate mortgage payments.*★

Essential Understandings	Content Skills
1-1, Algebra uses symbols to represent quantities that are unknown or that vary. Mathematical phrases and real-world relationships can be represented using symbols and operations. 1-2, Powers can be used to shorten the representation of repeated multiplication. 1-3, The definition of a square root can be used to find the exact square roots of some nonnegative numbers. Numbers can be classified by their characteristics. 1-4, Relationships that are always true for real numbers are called properties, which are rules used to rewrite and compare expressions. 1-5, Any real numbers can be added or subtracted using a number line model or using rules involving absolute value. 1-6, The rules for multiplying real numbers are related to the properties of real numbers and the definitions of operations. 1-7, The distributive property can be used to simplify the product of a number and a sum or difference. An algebraic expression can be simplified by combining the parts of the expression that are alike. 1-8, Equations are used to represent the relationship between two quantities that have the same value. 1-9, Sometimes the value of one quantity can be found if the value of another is known. The relationship between the quantities can be represented in different ways, including tables, equations, and graphs.	Students will: 1. Write algebraic expressions 2. Simplify expressions involving exponents 3. Use order of operations to evaluate expressions 4. To classify, graph, and compare real numbers 5. Find and estimate square roots 6. Identify and use properties of real numbers 7. Find sums and differences of real numbers 8. Find products and quotients of real numbers 9. Use the Distributive Property to simplify expressions 10. Solve equations using tables and mental math 11. Use tables, equations, and graphs to describe relationships

Understanding by Design

Essential Questions

1. How can you represent quantities, patterns, and relationships?
2. How are properties related to algebra?

Misconceptions

1. Order of operations: Students may think the rule for multiplication and division tells you to do multiplication and then division. Students need to learn that multiplication and division are on the same level and should be applied from left to right. The same thinking applies to addition and subtraction. These operations should also be applied left to right.
2. Real Numbers: Some students may have difficulty understanding the relationships among the various sets of numbers. (i.e. real, rational, irrational, integer, whole, etc.)
3. Substituting negative numbers for variables can lead to confusion for students.

Evidence of Learning	
Summative Traditional Assessment	Summative Performance Tasks
• Pretest • Quizzes • Chapter tests • Mid-year test • Post-test	• Activities, games, and puzzles • Projects • Daily warm up, Solve It(online) • Got It! • Key Concepts

Formative Assessments
• Class work/Homework • Student Companion Workbook/note taking • Practice sheets • Additional Vocabulary Support • Enrichment activities • Oral questioning • Student demonstration • Whiteboards • Standardized test prep

Learning Plan	
Interdisciplinary Connections	Technology Connections
• Concept Bytes • STEM questions focus on Science and Engineering • Problem solving exercises incorporate history, physiology, air travel, construction, etc. • Solve It – Covers a variety of curriculum areas, such as, geography, finance, gaming, etc.	• Smart board Technologies • PowerAlgebra.com • www.calculator.com • Green Globs • Graphing Calculators

Unit Resources
• Student Companion • Online text • Internet • Teacher Resource Materials

New Hanover Township School

Grade: Algebra I (grade 8)

Content Area: Mathematics

Chapter 2

Domain: Quantities, Creating Equations, and Reasoning with Equations and Inequalities

Common Core Standards

Quantities

CCSS.Math.Content.HSN-Q.A.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.

CCSS.Math.Content.HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling.

CCSS.Math.Content.HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

Creating Equations

CCSS.Math.Content.HSA-CED.A.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.*

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

CCSS.Math.Content.HSA-CED.A.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.*

CCSS.Math.Content.HSA-CED.A.4 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 and Inequalities

Understand solving equations as a process of reasoning and explain the reasoning.

CCSS.Math.Content.HSA-REI.A.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.

CCSS.Math.Content.HSA-REI.A.2 Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

Solve equations and inequalities in one variable.

CCSS.Math.Content.HSA-REI.B.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

CCSS.Math.Content.HSA-REI.B.4 Solve quadratic equations in one variable.

CCSS.Math.Content.HSA-REI.B.4a 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.

CCSS.Math.Content.HSA-REI.B.4b Solve quadratic equations by inspection (e.g., for $x^2 = 49$), 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.

Solve systems of equations.

CCSS.Math.Content.HSA-REI.C.5 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.

CCSS.Math.Content.HSA-REI.C.6 Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.

CCSS.Math.Content.HSA-REI.C.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 $x^2 + y^2 = 3$.

CCSS.Math.Content.HSA-REI.C.8 (+) Represent a system of linear equations as a single matrix equation in a vector variable.

CCSS.Math.Content.HSA-REI.C.9 (+) Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3 × 3 or greater).

Represent and solve equations and inequalities graphically.

CCSS.Math.Content.HSA-REI.D.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).

CCSS.Math.Content.HSA-REI.D.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.★

CCSS.Math.Content.HSA-REI.D.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.

Essential Understandings	Content Skills
2-1 through 2-5, Equivalent equations are equations that have the same solutions(s). In these lessons, students learn to use the properties of equality and inverse operations to find equivalent equations. 2-1 through 2-5, Equations can describe, explain, and predict various aspects of the real world,. In these lessons, students solve one-step, two-step and multi-step linear equations, as well as equations with variables on both sides. 2-6, Ratios and rates can be used to compare quantities and make conversions. 2-7, If two ratios are equal and a quantity in one of the ratios is unknown, the unknown quantity can be found by writing and solving a proportion. 2-8, Proportional reasoning can be used to find missing side lengths in similar figures. 2-9 to 2-10, Percents represent another application of proportions. The percent proportion can be used to solve for any one of the missing components and to solve percent increase and percent decrease problems.	1. To solve one-step equations in one variable 2. To solve two-step equations in one variable 3. To solve multi-step equations in one variable 4. To solve equations with variables on both sides 5. To identify equations that are identities or have no solution 6. To rewrite and use literal equations and formulas 7. To find ratios and rates 8. To convert units and rates 9. To solve and apply proportions 10. To find missing lengths in similar figures 11. To use similar figures when measuring indirectly 12. To solve percent problems using proportions 13. To solve percent problems using the percent equation 14. To find percent change 15. To find the relative error in linear and nonlinear measurements

Understanding by Design

Essential Questions

1. Can equations that appear to be different be equivalent?
2. How can you solve equations?
3. What kinds of relationships can proportions represent?

Misconceptions

1. Solving Equations – Some students have difficulty determining the number of solutions.
2. Solving Proportions - Students may try to use the Cross Products Property any time then encounter two fractions. They may overlook the fact that the expression is not an equation.
3. Percents and Proportions - Some students may believe that the value representing the base always follows the word "of".

Evidence of Learning

Summative Traditional Assessment	Summative Performance Tasks
• Pretest • Quizzes • Chapter tests • Mid-year test • Post-test	• Activities, games, and puzzles • Projects • Daily warm up, Solve It(online) • Got It! • Key Concepts

Formative Assessments

- Class work/Homework
- Student Companion Workbook/note taking
- Practice sheets
- Additional Vocabulary Support
- Enrichment activities
- Oral questioning
- Student demonstration
- Whiteboards

Standardized test prep

Learning Plan

Interdisciplinary Connections	Technology Connections
• Concept Bytes • STEM questions focus on Science and Engineering • Problem solving exercises incorporate history, physiology, air travel, construction, etc. • Solve It – Covers a variety of curriculum areas, such as, geography, finance, gaming, etc.	• Smart board Technologies • PowerAlgebra.com • www.calculator.com • Green Globs • Graphing Calculators

Unit Resources
• Student Companion • Online text • Internet • Teacher Resource Materials

New Hanover Township School

Grade: Algebra I (grade 8)

Content Area: Mathematics

Chapter 3

Domain: Seeing Structure in Expressions, Creating Equations, and Reasoning with Equations and Inequalities

Common Core Standards

Seeing Structure in Expressions

CCSS.Math.Content.HSA-SSE.A.1 Interpret expressions that represent a quantity in terms of its context.★

CCSS.Math.Content.HSA-SSE.A.1a Interpret parts of an expression, such as terms, factors, and coefficients.

CCSS.Math.Content.HSA-SSE.A.1b 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.*

CCSS.Math.Content.HSA-SSE.A.2 Use the structure of an expression to identify ways to rewrite it. *For example, see* $x^4 - y^4$ *as* $(x^2)^2 - (y^2)^2$*, thus recognizing it as a difference of squares that can be factored as* $(x^2 - y^2)(x^2 + y^2)$*.*

CCSS.Math.Content.HSA-SSE.B.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.★

CCSS.Math.Content.HSA-SSE.B.3a Factor a quadratic expression to reveal the zeros of the function it defines.

CCSS.Math.Content.HSA-SSE.B.3b Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.

CCSS.Math.Content.HSA-SSE.B.3c Use the properties of exponents to transform expressions for exponential functions. *For example the expression* 1.15^t *can be rewritten as* $(1.15^{1/12})^{12t} \approx 1.012^{12t}$ *to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.*

CCSS.Math.Content.HSA-SSE.B.4 Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. *For example, calculate mortgage payments.*★

Creating Equations

CCSS.Math.Content.HSA-CED.A.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.*

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

CCSS.Math.Content.HSA-CED.A.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.*

CCSS.Math.Content.HSA-CED.A.4 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 and Inequalities

Understand solving equations as a process of reasoning and explain the reasoning.

CCSS.Math.Content.HSA-REI.A.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.

CCSS.Math.Content.HSA-REI.A.2 Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

Solve equations and inequalities in one variable.

CCSS.Math.Content.HSA-REI.B.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

CCSS.Math.Content.HSA-REI.B.4 Solve quadratic equations in one variable.

CCSS.Math.Content.HSA-REI.B.4a 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.

CCSS.Math.Content.HSA-REI.B.4b Solve quadratic equations by inspection (e.g., for $x^2 = 49$), 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.

Solve systems of equations.

CCSS.Math.Content.HSA-REI.C.5 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.

CCSS.Math.Content.HSA-REI.C.6 Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.

CCSS.Math.Content.HSA-REI.C.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 $x^2 + y^2 = 3$.

CCSS.Math.Content.HSA-REI.C.8 (+) Represent a system of linear equations as a single matrix equation in a vector variable.

CCSS.Math.Content.HSA-REI.C.9 (+) Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3 × 3 or greater).

Represent and solve equations and inequalities graphically.

CCSS.Math.Content.HSA-REI.D.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).

CCSS.Math.Content.HSA-REI.D.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.★

CCSS.Math.Content.HSA-REI.D.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.

Essential Understandings	Content Skills
3-1, An inequality is a mathematical sentence that uses an inequality symbol to compare the values of two expressions. Inequalities can be represented with symbols. Their solutions can be represented on a number line. 3-2 to 3-6, Just as properties of equality can be used to solve equations, properties of inequality can be used to solve inequalities. 3-2 to 3-6, Just as equivalent equations can be used to solve equations, equivalent inequalities can be used to solve inequalities. 3-2 to 3-6, Just as equations can be solved using the properties of equality, inequalities can be solved using the properties of inequality. 3-7, An equivalent pair of linear equations or inequalities can be used to solve absolute value equations and inequalities. 3-7, Absolute value equations and inequalities can be solved by first isolating the absolute value expression, if necessary, then writing an equivalent pair of linear equations or inequalities.	1. To write, graph, and identify solutions of inequalities 2. To use addition or subtraction to solve inequalities 3. To use multiplication or division to solve inequaltiies 4. To solve multi-step inequalities 5. To write sets and identify subsets 6. To find the complement of a set 7. To solve and graph inequalities containing the word "and" 8. To solve and graph inequalities containing the word "or" 9. To solve equations and inequalities involving absolute value 10. To find the unions and intersections of sets

Understanding by Design

Essential Questions

1. How do you represent relationships between quantities that are not equal?
2. Can inequalities that appear to be different be equivalent?
3. How can you solve inequalities?

Misconceptions

Graphing Inequalities – Graphing compound inequalities requires that students remember that ***and*** means intersection and ***or*** means union. Explain that ***and*** implies that both inequalities are true, so the solutions must satisfy both inequalities. ***Or*** implies that either of the inequalities can be true, so all solutions are included in the set.

Equivalent Inequalities – Multiplying and dividing an inequality be a negative number requires students to remember to reverse the inequality symbol. Students make two common errors with regards to this rule. They either simply forget to change the sign or they change the symbol when there is a negative number in the problem, even though the problem may not require multiplying or dividing by a negative.

Evidence of Learning

Summative Traditional Assessment	Summative Performance Tasks
• Pretest • Quizzes • Chapter tests • Mid-year test • Post-test	• Activities, games, and puzzles • Projects • Daily warm up, Solve It(online) • Got It! • Key Concepts

Formative Assessments

- Class work/Homework
- Student Companion Workbook/note taking
- Practice sheets
- Additional Vocabulary Support
- Enrichment activities
- Oral questioning
- Student demonstration
- Whiteboards
- Standardized test prep

Learning Plan

Interdisciplinary Connections

- Concept Bytes
- STEM questions focus on Science and Engineering
- Problem solving exercises incorporate history, physiology, air travel, construction, etc.
- Solve It – Covers a variety of curriculum areas, such as, geography, finance, gaming, etc.

Technology Connections

- Smart board Technologies
- PowerAlgebra.com
- www.calculator.com
- Green Globs
- Graphing Calculators

Unit Resources

- Student Companion
- Online text
- Internet
- Teacher Resource Materials

New Hanover Township School

Grade: Algebra I (grade 8)

Content Area: Mathematics

Chapter 4

Domain: Interpreting Functions and Building Functions

Common Core Standards

Interpreting Functions

Understand the concept of a function and use function notation.

CCSS.Math.Content.HSF-IF.A.1 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*).

CCSS.Math.Content.HSF-IF.A.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

CCSS.Math.Content.HSF-IF.A.3 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.*

Interpret functions that arise in applications in terms of the context.

CCSS.Math.Content.HSF-IF.B.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.*★

CCSS.Math.Content.HSF-IF.B.5 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.*★

CCSS.Math.Content.HSF-IF.B.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.

Building Functions

CCSS.Math.Content.HSF-BF.A.1 Write a function that describes a relationship between two quantities.★

CCSS.Math.Content.HSF-BF.A.1a Determine an explicit expression, a recursive process, or steps for calculation from a context.

CCSS.Math.Content.HSF-BF.A.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.*

CCSS.Math.Content.HSF-BF.A.1c (+) Compose functions. *For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.*

CCSS.Math.Content.HSF-BF.A.2 Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.★

Essential Understandings	Content Skills
4-1 Graphs can be used to visually represent the relationship between two variable quantities as then change. 4-2, The value of one variable may be uniquely determined by the value of another variable. Such relationships may be represented using words, tables, equations, sets of ordered pairs, and graphs. 4-3 to 4-6, Functions (linear and nonlinear) are a special type of relation where each value in the domain is paired with exactly one value in the range. Some functions can be graphed or represented by equations. 4-4, The set of all solutions of an equation forms its graph. A graph may include solutions that do not appear in a table. A real world graph should show only points that make sense in the given situation. 4-5, Many real world functional relationships can be represented by equations. Equations can be used to find the solution of given real world problems. 4-7, Arithmetic sequences have function rules that can be used to find any term of the sequence.	1. To represent mathematical relationships using graphs 2. To identify and represent patterns that describe linear functions 3. To identify and represent patterns that describe nonlinear functions 4. To graph equations that represent functions 5. To write equations that represent functions 6. To determine whether a relation is a function 7. To find domain and range and use function notation 8. To identify and extend patterns in sequences 9. To represent arithmetic sequences using function notation

Understanding by Design

Essential Questions

1. How can you represent and describe functions?
2. Can functions describe real world situations?

Misconceptions

Linear Functions – Given an equation in the form x=k, students might identify it as a linear function. Although this is a linear equation, it is not a linear function.
Functions – When using a table with consecutive x-values to determine if a function is linear or not, all of the differences must be the same. Students who do not check enough values might conclude that the pattern describes a linear function when it does not.
Sequences – When finding the differences between consecutive values of an arithmetic sequence, students might subtract succeeding terms instead of preceding terms.

Evidence of Learning	
Summative Traditional Assessment	Summative Performance Tasks
• Pretest • Quizzes • Chapter tests • Mid-year test • Post-test	• Activities, games, and puzzles • Projects • Daily warm up, Solve It(online) • Got It! • Key Concepts

Formative Assessments
• Class work/Homework • Student Companion Workbook/note taking • Practice sheets • Additional Vocabulary Support • Enrichment activities • Oral questioning • Student demonstration • Whiteboards • Standardized test prep

Learning Plan	
Interdisciplinary Connections	Technology Connections
• Concept Bytes • STEM questions focus on Science and Engineering • Problem solving exercises incorporate history, physiology, air travel, construction, etc. • Solve It – Covers a variety of curriculum areas, such as, geography, finance, gaming, etc.	• Smart board Technologies • PowerAlgebra.com • www.calculator.com • Green Globs • Graphing Calculators

Unit Resources
• Student Companion • Online text • Internet • Teacher Resource Materials

New Hanover Township School

Grade: Algebra I (grade 8)

Content Area: Mathematics

Chapter 5

Domain: Interpreting Functions, Building Functions, and Interpreting Categorical and Quantitative Data

Common Core Standards

Interpreting Functions

Understand the concept of a function and use function notation.

CCSS.Math.Content.HSF-IF.A.1 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*).

CCSS.Math.Content.HSF-IF.A.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

CCSS.Math.Content.HSF-IF.A.3 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.*

Interpret functions that arise in applications in terms of the context.

CCSS.Math.Content.HSF-IF.B.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.*★

CCSS.Math.Content.HSF-IF.B.5 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.*★

CCSS.Math.Content.HSF-IF.B.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.

Building Functions

CCSS.Math.Content.HSF-BF.A.1 Write a function that describes a relationship between two quantities.★

CCSS.Math.Content.HSF-BF.A.1a Determine an explicit expression, a recursive process, or steps for calculation from a context.

CCSS.Math.Content.HSF-BF.A.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*.

CCSS.Math.Content.HSF-BF.A.1c (+) Compose functions. *For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time*.

CCSS.Math.Content.HSF-BF.A.2 Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.★

Interpreting Categorical and Quantitative Data

CCSS.Math.Content.HSS-ID.B.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.

CCSS.Math.Content.HSS-ID.B.6b Informally assess the fit of a function by plotting and analyzing residuals.

CCSS.Math.Content.HSS-ID.B.6c Fit a linear function for a scatter plot that suggests a linear association.

Interpret linear models

CCSS.Math.Content.HSS-ID.C.7 Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.

CCSS.Math.Content.HSS-ID.C.8 Compute (using technology) and interpret the correlation coefficient of a linear fit.

CCSS.Math.Content.HSS-ID.C.9 Distinguish between correlation and causation.

Essential Understandings	Content Skills
5-1, Ratios can be used to show a relationship between changing quantities, such as vertical and horizontal change. 5-2, If the ratio of two variables is constant, then the variables have a special relationship, called a direct variation. 5-3 to 5-5, a line on a graph can be represented by a linear equation. Forms of linear equations include the Slope-Intercept, Point-Slope, and Standard forms. 5-6, the relationship between two lines can be determined by comparing their slopes and y-intercepts. 5-7, Two sets of numerical data can be graphed as ordered pairs. If the two sets of data are related, a line on the graph can be used to estimate or predict values.	1.To find rates of change from tables 2. To find slope 3. To write and graph an equation of a direct variation 4. To write linear equations using slope-intercept form 5. To graph linear equations in slope-intercept form 6. To write and graph linear equations using point-slope form 7. To graph linear equations using intercepts. 8. To write linear equations in standard form. 9. To determine whether lines are parallel, perpendicular, or neither 10. To write equations of parallel lines and perpendicular lines 11. To write an equation of a trend line and of a line of

5-8, Absolute value equations can be graphed quickly by shifting the graph of y=|x|	best fit 12. To use a trend line and a line of best fit to make predictions 13. To graph an absolute value function 14. To translate the graph of an absolute value function

Understanding by Design

Essential Questions

1. What does the slope of a line indicate about the line?
2. What information does the equation of a line give you?
3. How can you make predictions based on a scatter plot?

Misconceptions

Slope – Although it does not matter which point is identified as (x1,y1) and which one is defined as (x2,y2), it is important that the same order is used for the numerator as for the denominator. If students mix up the order, the slope will be incorrect.
Forms of Linear Equations – The operation signs in the point-slope formula are subtraction, so negative x1 and y1 values will change the signs to addition

Evidence of Learning

Summative Traditional Assessment	Summative Performance Tasks
• Pretest • Quizzes • Chapter tests • Mid-year test • Post-test	• Activities, games, and puzzles • Projects • Daily warm up, Solve It(online) • Got It! • Key Concepts

Formative Assessments

- Class work/Homework
- Student Companion Workbook/note taking
- Practice sheets
- Additional Vocabulary Support
- Enrichment activities
- Oral questioning
- Student demonstration
- Whiteboards
- Standardized test prep

Learning Plan	
Interdisciplinary Connections	Technology Connections
• Concept Bytes • STEM questions focus on Science and Engineering • Problem solving exercises incorporate history, physiology, air travel, construction, etc. • Solve It – Covers a variety of curriculum areas, such as, geography, finance, gaming, etc.	• Smart board Technologies • PowerAlgebra.com • www.calculator.com • Green Globs • Graphing Calculators

Unit Resources
• Student Companion • Online text • Internet • Teacher Resource Materials

New Hanover Township School

Grade: Algebra I (grade 8)

Content Area: Mathematics

Chapter 6

Domain: Creating Equations, Reasoning with Equations and Inequalities, and Interpreting Categorical and Quantitative Data

Common Core Standards

Creating Equations

CCSS.Math.Content.HSA-CED.A.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.*

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

CCSS.Math.Content.HSA-CED.A.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.*

CCSS.Math.Content.HSA-CED.A.4 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 and Inequalities

Understand solving equations as a process of reasoning and explain the reasoning.

CCSS.Math.Content.HSA-REI.A.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.

CCSS.Math.Content.HSA-REI.A.2 Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

Solve equations and inequalities in one variable.

CCSS.Math.Content.HSA-REI.B.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

CCSS.Math.Content.HSA-REI.B.4 Solve quadratic equations in one variable.

CCSS.Math.Content.HSA-REI.B.4a 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.

CCSS.Math.Content.HSA-REI.B.4b Solve quadratic equations by inspection (e.g., for $x^2 = 49$), 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.

Solve systems of equations.

CCSS.Math.Content.HSA-REI.C.5 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.

CCSS.Math.Content.HSA-REI.C.6 Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.

CCSS.Math.Content.HSA-REI.C.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 $x^2 + y^2 = 3$.

CCSS.Math.Content.HSA-REI.C.8 (+) Represent a system of linear equations as a single matrix equation in a vector variable.

CCSS.Math.Content.HSA-REI.C.9 (+) Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3 × 3 or greater).

Represent and solve equations and inequalities graphically.

CCSS.Math.Content.HSA-REI.D.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).

CCSS.Math.Content.HSA-REI.D.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.★

CCSS.Math.Content.HSA-REI.D.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.

Interpreting Categorical and Quantitative Data

CCSS.Math.Content.HSS-ID.B.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.

CCSS.Math.Content.HSS-ID.B.6b Informally assess the fit of a function by plotting and analyzing residuals.

CCSS.Math.Content.HSS-ID.B.6c Fit a linear function for a scatter plot that suggests a linear association.

Interpret linear models

CCSS.Math.Content.HSS-ID.C.7 Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.

CCSS.Math.Content.HSS-ID.C.8 Compute (using technology) and interpret the correlation coefficient of a linear fit.

CCSS.Math.Content.HSS-ID.C.9 Distinguish between correlation and causation.

Essential Understandings	Content Skills
6-1, Some problems can be modeled by systems of linear equations. 6-1 to 6-3, Systems of linear equations can be used to model problems. Systems of equations can be solved by graphing, substitution, or eliminating a variable. 6-5 to 6-6, A linear inequality in two variables has an infinite number of solutions. These solutions can be	1. To solve systems of equations by graphing 2. To analyze special systems 3. To solve systems of equations using substitution 4. To solve systems by adding or subtracting to eliminate a variable 5. To choose the best method for solving a system of linear equations

represented in the coordinate plane as the set of all points on one side of a boundary line. The solutions of a system of linear inequalities can be represented by the region where the graphs of the individual inequalities overlap. 6-5 to 6-6, Solutions to a linear inequality in two variables can be represented in the coordinate plane as the set of all points on one side of a boundary line. The solutions of a system of linear inequalities can be represented by the region where the graphs of the individual inequalities overlap.	6. To graph linear inequalities in two variables 7. To use linear inequalities when modeling real-world situations 8. To solve systems of linear inequalities by graphing 9. To model real-world situations using systems of linear inequalities

Understanding by Design

Essential Questions

1. How can you solve a system of equations or inequalities?
2. Can systems of equations model real-world situations?

Misconceptions

Solving systems of Equations Graphically - Students may mistake a system with infinite solutions for a system with no solutions.
Solving systems of Equations Algebraically – When solving by substitution, students may substitute into the same equation they used to isolate a variable.

Evidence of Learning

Summative Traditional Assessment	Summative Performance Tasks
• Pretest • Quizzes • Chapter tests • Mid-year test • Post-test	• Activities, games, and puzzles • Projects • Daily warm up, Solve It(online) • Got It! • Key Concepts

Formative Assessments

- Class work/Homework
- Student Companion Workbook/note taking
- Practice sheets
- Additional Vocabulary Support
- Enrichment activities
- Oral questioning
- Student demonstration
- Whiteboards
- Standardized test prep

Learning Plan	
Interdisciplinary Connections	Technology Connections
• Concept Bytes • STEM questions focus on Science and Engineering • Problem solving exercises incorporate history, physiology, air travel, construction, etc. • Solve It – Covers a variety of curriculum areas, such as, geography, finance, gaming, etc.	• Smart board Technologies • PowerAlgebra.com • www.calculator.com • Green Globs • Graphing Calculators

Unit Resources
• Student Companion • Online text • Internet • Teacher Resource Materials

New Hanover Township School

Grade: Algebra I (grade 8)

Content Area: Mathematics

Chapter 7

Domain: Real Number System, Seeing Structure in Expressions, and Linear, Quadratic and Exponential Models

Common Core Standards

The Real Number System

Extend the properties of exponents to rational exponents.

CCSS.Math.Content.HSN-RN.A.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 $5^{1/3}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5^{(1/3)3}$ to hold, so $(5^{1/3})^3$ must equal 5.*

CCSS.Math.Content.HSN-RN.A.2 Rewrite expressions involving radicals and rational exponents using the properties of exponents.

Use properties of rational and irrational numbers.

CCSS.Math.Content.HSN-RN.B.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.

Seeing Structure in Expressions

CCSS.Math.Content.HSA-SSE.A.1 Interpret expressions that represent a quantity in terms of its context.★

CCSS.Math.Content.HSA-SSE.A.1a Interpret parts of an expression, such as terms, factors, and coefficients.

CCSS.Math.Content.HSA-SSE.A.1b 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.*

CCSS.Math.Content.HSA-SSE.A.2 Use the structure of an expression to identify ways to rewrite it. *For example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$.*

CCSS.Math.Content.HSA-SSE.B.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.★

CCSS.Math.Content.HSA-SSE.B.3a Factor a quadratic expression to reveal the zeros of the function it defines.

CCSS.Math.Content.HSA-SSE.B.3b Complete the square in a quadratic expression to reveal the maximum or minimum value of the function

it defines.

CCSS.Math.Content.HSA-SSE.B.3c Use the properties of exponents to transform expressions for exponential functions. *For example the expression* 1.15^t *can be rewritten as* $(1.15^{1/12})^{12t} \approx 1.012^{12t}$ *to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.*

CCSS.Math.Content.HSA-SSE.B.4 Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. *For example, calculate mortgage payments.*⋆

Linear, Quadratic, and Exponential Models

Construct and compare linear, quadratic, and exponential models and solve problems.

CCSS.Math.Content.HSF-LE.A.1 Distinguish between situations that can be modeled with linear functions and with exponential functions.

CCSS.Math.Content.HSF-LE.A.1a Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.

CCSS.Math.Content.HSF-LE.A.1b Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.

CCSS.Math.Content.HSF-LE.A.1c Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

CCSS.Math.Content.HSF-LE.A.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).

CCSS.Math.Content.HSF-LE.A.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.

CCSS.Math.Content.HSF-LE.A.4 For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.

Interpret expressions for functions in terms of the situation they model.

CCSS.Math.Content.HSF-LE.B.5 Interpret the parameters in a linear or exponential function in terms of a context.

Essential Understandings	Content Skills
7-1, The idea of exponents can be extended to include zero and negative exponents. 7-2 to 7-4, Properties of exponents make it easier to simplify products or quotients of powers with the same base or powers raised to a power or products raised to a power. 7-5, You can use rational exponents to represent radicals. 7-6 to 7-7, The parent of the family of exponential functions is y=ab^x. The independent variable is an exponent. This family of functions can model growth or decay of an initial amount. 7-8, In a geometric sequence, the ratio of any term to its preceding term is a constant value.	1. To simplify expressions involving zero and negative exponents. 2. To multiply powers with the same base 3. To raise a power to a power 4. To raise a product to a power 5. To divide powers with the same base 6. To raise a quotient to a power 7. To rewrite expressions involving radicals and rational exponents 8. To evaluate and graph exponential functions 9. To model exponential growth and decay 10. To write and use recursive formulas for geometric sequences

Understanding by Design

Essential Questions

1. How can you represent numbers less than 1 using exponents?
2. How can you simplify expressions involving exponents?
3. What are the characteristics of exponential functions?

Misconceptions

Properties of Exponents – When multiplying powers with the same base, students often make the mistake of multiplying the powers rather than adding them.
Scientific Notation – Students are often confused when working with numbers in scientific notation in which the power of ten involves a negative exponent.
Exponential Functions – Stress the importance of the value of b in the exponential function y=b^x. If b<0, the behavior of the function can be counter intuitive to students. If b>0, y gets larger, if b<0 y gets smaller.

Evidence of Learning

Summative Traditional Assessment

- Pretest
- Quizzes
- Chapter tests
- Mid-year test
- Post-test

Summative Performance Tasks

- Activities, games, and puzzles
- Projects
- Daily warm up, Solve It(online)
- Got It!
- Key Concepts

Formative Assessments

- Class work/Homework
- Student Companion Workbook/note taking
- Practice sheets
- Additional Vocabulary Support
- Enrichment activities
- Oral questioning
- Student demonstration
- Whiteboards
- Standardized test prep

Learning Plan

Interdisciplinary Connections

- Concept Bytes
- STEM questions focus on Science and Engineering
- Problem solving exercises incorporate history, physiology, air travel, construction, etc.
- Solve It – Covers a variety of curriculum areas, such as, geography, finance, gaming, etc.

Technology Connections

- Smart board Technologies
- PowerAlgebra.com
- www.calculator.com
- Green Globs
- Graphing Calculators

Unit Resources
• Student Companion • Online text • Internet • Teacher Resource Materials

New Hanover Township School

Grade: Algebra I (grade 8)

Content Area: Mathematics

Chapter 8

Domain: Seeing Structure in Expressions and Arithmetic with Polynomials and Rational Expressions

Common Core Standards

Seeing Structure in Expressions

CCSS.Math.Content.HSA-SSE.A.1 Interpret expressions that represent a quantity in terms of its context.★

CCSS.Math.Content.HSA-SSE.A.1a Interpret parts of an expression, such as terms, factors, and coefficients.

CCSS.Math.Content.HSA-SSE.A.1b 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.*

CCSS.Math.Content.HSA-SSE.A.2 Use the structure of an expression to identify ways to rewrite it. *For example, see* $x^4 - y^4$ *as* $(x^2)^2 - (y^2)^2$, *thus recognizing it as a difference of squares that can be factored as* $(x^2 - y^2)(x^2 + y^2)$.

CCSS.Math.Content.HSA-SSE.B.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.★

CCSS.Math.Content.HSA-SSE.B.3a Factor a quadratic expression to reveal the zeros of the function it defines.

CCSS.Math.Content.HSA-SSE.B.3b Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.

CCSS.Math.Content.HSA-SSE.B.3c Use the properties of exponents to transform expressions for exponential functions. *For example the expression* 1.15^t *can be rewritten as* $(1.15^{1/12})^{12t} \approx 1.012^{12t}$ *to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.*

CCSS.Math.Content.HSA-SSE.B.4 Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. *For example, calculate mortgage payments.*★

Arithmetic with Polynomials and Rational Expressions

Perform arithmetic operations on polynomials.

CCSS.Math.Content.HSA-APR.A.1 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.

Understand the relationship between zeros and factors of polynomials.

CCSS.Math.Content.HSA-APR.B.2 Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a

number a, the remainder on division by $x - a$ is $p(a)$, so $p(a) = 0$ if and only if $(x - a)$ is a factor of $p(x)$.

CCSS.Math.Content.HSA-APR.B.3 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.

Use polynomial identities to solve problems.

CCSS.Math.Content.HSA-APR.C.4 Prove polynomial identities and use them to describe numerical relationships. *For example, the polynomial identity* $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$ *can be used to generate Pythagorean triples.*

CCSS.Math.Content.HSA-APR.C.5 (+) Know and apply the Binomial Theorem for the expansion of $(x + y)^n$ in powers of x and y for a positive integer n, where x and y are any numbers, with coefficients determined for example by Pascal's Triangle.[1]

Rewrite rational expressions.

CCSS.Math.Content.HSA-APR.D.6 Rewrite simple rational expressions in different forms; write $^{a(x)}/_{b(x)}$ in the form $q(x) + {}^{r(x)}/_{b(x)}$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$, using inspection, long division, or, for the more complicated examples, a computer algebra system.

CCSS.Math.Content.HSA-APR.D.7 (+) Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.

Essential Understandings	Content Skills
8-1, Monomials can be used to form larger expressions called polynomials. Polynomials can be added and subtracted. 8-2 to 8-4 – The properties of real numbers can be used to multiply a monomial be a polynomial or simplify the product of binomials. 8-3 to 8-4 – There are several ways to find the product of two binomials, including models, algebra, and tables. 8-5 to 8-8 – Some trinomials of the form ax^2 +bx+c and some polynomials of a degree greater than 2 can be factored to equivalent forms which are the product of two binomials 8-5 to 8-8 – The properties of real numbers can also be used to factor some trinomials of the form as^2 + bx + c and some polynomials of a degree greater than 2.	1. To classify, add, and subtract polynomials 2. To multiply a monomial by a polynomial 3. To factor a monomial from a polynomial 4. To multiply two binomials or a binomial by a trinomial 5. To find the square of a binomial and to find the product of a sum and difference 6. To factor trinomials of the form x^2 + bx + c 7. To factor trinomials of the form ax^2 + bx + c 8. To factor perfect square trinomials and the differences of two squares 9. To factor higher degree polynomials by grouping 10.

Understanding by Design
Essential Questions
1. Can two algebraic expressions that appear to be different be equivalent? 2. How are the properties of real numbers related to polynomials?

Misconceptions

Adding and Subtracting Polynomials – Students might try to add and subtract exponents, especially if the coefficients for the monomials are 1.
Multiplying Binomials – When multiplying binomials, students often make mistakes related to the signs of the terms.

Evidence of Learning

Summative Traditional Assessment	Summative Performance Tasks
• Pretest • Quizzes • Chapter tests • Mid-year test • Post-test	• Activities, games, and puzzles • Projects • Daily warm up, Solve It(online) • Got It! • Key Concepts

Formative Assessments

- Class work/Homework
- Student Companion Workbook/note taking
- Practice sheets
- Additional Vocabulary Support
- Enrichment activities
- Oral questioning
- Student demonstration
- Whiteboards
- Standardized test prep

Learning Plan

Interdisciplinary Connections	Technology Connections
• Concept Bytes • STEM questions focus on Science and Engineering • Problem solving exercises incorporate history, physiology, air travel, construction, etc. • Solve It – Covers a variety of curriculum areas, such as, geography, finance, gaming, etc.	• Smart board Technologies • PowerAlgebra.com • www.calculator.com • Green Globs • Graphing Calculators

Unit Resources

- Student Companion
- Online text
- Internet
- Teacher Resource Materials

New Hanover Township School

Grade: Algebra I (grade 8)

Content Area: Mathematics

Chapter 9

Domain: Seeing Structure in Expressions, Reasoning with Equations and Inequalities, and Interpreting Functions

Common Core Standards

Seeing Structure in Expressions

CCSS.Math.Content.HSA-SSE.A.1 Interpret expressions that represent a quantity in terms of its context.★

CCSS.Math.Content.HSA-SSE.A.1a Interpret parts of an expression, such as terms, factors, and coefficients.

CCSS.Math.Content.HSA-SSE.A.1b 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.*

CCSS.Math.Content.HSA-SSE.A.2 Use the structure of an expression to identify ways to rewrite it. *For example, see* $x^4 - y^4$ *as* $(x^2)^2 - (y^2)^2$*, thus recognizing it as a difference of squares that can be factored as* $(x^2 - y^2)(x^2 + y^2)$*.*

CCSS.Math.Content.HSA-SSE.B.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.★

CCSS.Math.Content.HSA-SSE.B.3a Factor a quadratic expression to reveal the zeros of the function it defines.

CCSS.Math.Content.HSA-SSE.B.3b Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.

CCSS.Math.Content.HSA-SSE.B.3c Use the properties of exponents to transform expressions for exponential functions. *For example the expression* 1.15^t *can be rewritten as* $(1.15^{1/12})^{12t} \approx 1.012^{12t}$ *to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.*

CCSS.Math.Content.HSA-SSE.B.4 Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. *For example, calculate mortgage payments.*★

Reasoning with Equations and Inequalities

Understand solving equations as a process of reasoning and explain the reasoning.

CCSS.Math.Content.HSA-REI.A.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.

CCSS.Math.Content.HSA-REI.A.2 Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

Solve equations and inequalities in one variable.

CCSS.Math.Content.HSA-REI.B.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented

by letters.

CCSS.Math.Content.HSA-REI.B.4 Solve quadratic equations in one variable.

CCSS.Math.Content.HSA-REI.B.4a 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.

CCSS.Math.Content.HSA-REI.B.4b Solve quadratic equations by inspection (e.g., for $x^2 = 49$), 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.

Solve systems of equations.

CCSS.Math.Content.HSA-REI.C.5 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.

CCSS.Math.Content.HSA-REI.C.6 Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.

CCSS.Math.Content.HSA-REI.C.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 $x^2 + y^2 = 3$.

CCSS.Math.Content.HSA-REI.C.8 (+) Represent a system of linear equations as a single matrix equation in a vector variable.

CCSS.Math.Content.HSA-REI.C.9 (+) Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3 × 3 or greater).

Represent and solve equations and inequalities graphically.

CCSS.Math.Content.HSA-REI.D.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).

CCSS.Math.Content.HSA-REI.D.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.★

CCSS.Math.Content.HSA-REI.D.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.

Interpreting Functions

Understand the concept of a function and use function notation.

CCSS.Math.Content.HSF-IF.A.1 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 $y = f(x)$.

CCSS.Math.Content.HSF-IF.A.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

CCSS.Math.Content.HSF-IF.A.3 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 $n \geq 1$.*

Interpret functions that arise in applications in terms of the context.

CCSS.Math.Content.HSF-IF.B.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.*★

CCSS.Math.Content.HSF-IF.B.5 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.*★

CCSS.Math.Content.HSF-IF.B.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.

Essential Understandings	Content Skills
9-1, the family of quadratic functions models certain situations where the rate of change is not constant. These functions are graphed by a symmetric curve with a highest or lowest point corresponding to a maximum or minimum value. 9-2, In the quadratic function y=ax^2 + bx + c, the value of b translates the position of the axis of symmetry. 9-3 to 9-6, Quadratic equations can be solved by a variety of methods, including graphing and finding the square root, using the Zero-Product Property, writing the equation in the form m^2=n, or using the Quadratic formula. 9-7, Linear, quadratic, or exponential functions can be used to model various sets of data. 9-8, Systems of linear and quadratic equations can be solved graphically and algebraically. This type of system can have two solutions, one solution, or no solutions.	1. To graph quadratic functions of the form y = ax^2 and y=ax^2 + c 2. To graph quadratic functions of the form y=ax^2 + bx + c 3. To solve quadratic equations by graphing and using square roots 4. To solve quadratic equations by factoring 5. To solve quadratic equations by completing the square 6. To solve quadratic equations using the quadratic formula 7. To find the number of solutions of a quadratic equation 8. To choose a linear, quadratic, or exponential model for data 9. To solve systems of linear and quadratic equations

Understanding by Design

Essential Questions

1. What are the characteristics of quadratic functions?
2. How can you solve a quadratic equation?
3. How can you use functions to model real-world situations?

Misconceptions

Factoring (and the Zero-Product Property) – When factoring quadratic expressions, students might not figure the factors correctly.
Completing the Square – When completing the square to solve a quadratic equation, students might forget to add the value that completes the square to both sides.
The Quadratic Formula – Students may forget or confuse parts of the Quadratic formula. For example, they may compute using b in place of –b or divide by a instead of 2a. They may also make a mistake when subtracting 4ac as part of the radical if either a or c is negative. To counter these tendencies, students should write out the formula with the substituted values, checking each sign, and simplify step by step without attempting to do any two steps at once.

Evidence of Learning	
Summative Traditional Assessment	Summative Performance Tasks
• Pretest • Quizzes • Chapter tests • Mid-year test • Post-test	• Activities, games, and puzzles • Projects • Daily warm up, Solve It(online) • Got It! • Key Concepts

Formative Assessments
• Class work/Homework • Student Companion Workbook/note taking • Practice sheets • Additional Vocabulary Support • Enrichment activities • Oral questioning • Student demonstration • Whiteboards • Standardized test prep

Learning Plan	
Interdisciplinary Connections	Technology Connections
• Concept Bytes • STEM questions focus on Science and Engineering • Problem solving exercises incorporate history, physiology, air travel, construction, etc. • Solve It – Covers a variety of curriculum areas, such as, geography, finance, gaming, etc.	• Smart board Technologies • PowerAlgebra.com • www.calculator.com • Green Globs • Graphing Calculators

Unit Resources
• Student Companion • Online text • Internet • Teacher Resource Materials

New Hanover Township School

Grade: Algebra I (grade 8)

Content Area: Mathematics

Chapter 10

Domain: Reasoning with Equations and Inequalities, Interpreting functions, and Similarity, Right Triangles, and Trigonometry

Common Core Standards

Reasoning with Equations and Inequalities

Understand solving equations as a process of reasoning and explain the reasoning.

CCSS.Math.Content.HSA-REI.A.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.

CCSS.Math.Content.HSA-REI.A.2 Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

Solve equations and inequalities in one variable.

CCSS.Math.Content.HSA-REI.B.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

CCSS.Math.Content.HSA-REI.B.4 Solve quadratic equations in one variable.

CCSS.Math.Content.HSA-REI.B.4a 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.

CCSS.Math.Content.HSA-REI.B.4b Solve quadratic equations by inspection (e.g., for $x^2 = 49$), 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.

Solve systems of equations.

CCSS.Math.Content.HSA-REI.C.5 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.

CCSS.Math.Content.HSA-REI.C.6 Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.

CCSS.Math.Content.HSA-REI.C.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 $x^2 + y^2 = 3$.

CCSS.Math.Content.HSA-REI.C.8 (+) Represent a system of linear equations as a single matrix equation in a vector variable.

CCSS.Math.Content.HSA-REI.C.9 (+) Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3 × 3 or greater).

Represent and solve equations and inequalities graphically.

CCSS.Math.Content.HSA-REI.D.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).

CCSS.Math.Content.HSA-REI.D.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.★

CCSS.Math.Content.HSA-REI.D.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.

Interpreting Functions

Understand the concept of a function and use function notation.

CCSS.Math.Content.HSF-IF.A.1 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 $y = f(x)$.

CCSS.Math.Content.HSF-IF.A.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

CCSS.Math.Content.HSF-IF.A.3 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 $n \geq 1$.*

Interpret functions that arise in applications in terms of the context.

CCSS.Math.Content.HSF-IF.B.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.*★

CCSS.Math.Content.HSF-IF.B.5 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.*★

CCSS.Math.Content.HSF-IF.B.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.

Similarity, Right Triangles, and Trigonometry

Understand similarity in terms of similarity transformations

CCSS.Math.Content.HSG-SRT.A.1 Verify experimentally the properties of dilations given by a center and a scale factor:

CCSS.Math.Content.HSG-SRT.A.1a A dilation takes a line not passing through the center of the dilation

to a parallel line, and leaves a line passing through the center unchanged.

CCSS.Math.Content.HSG-SRT.A.1b The dilation of a line segment is longer or shorter in the ratio given by the scale factor.

CCSS.Math.Content.HSG-SRT.A.2 Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.

CCSS.Math.Content.HSG-SRT.A.3 Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.

Prove theorems involving similarity

CCSS.Math.Content.HSG-SRT.B.4 Prove theorems about triangles. *Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.*

CCSS.Math.Content.HSG-SRT.B.5 Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.

Define trigonometric ratios and solve problems involving right triangles

CCSS.Math.Content.HSG-SRT.C.6 Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.

CCSS.Math.Content.HSG-SRT.C.7 Explain and use the relationship between the sine and cosine of complementary angles.

CCSS.Math.Content.HSG-SRT.C.8 Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.★

Apply trigonometry to general triangles

CCSS.Math.Content.HSG-SRT.D.9 (+) Derive the formula $A = 1/2\ ab \sin(C)$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.

CCSS.Math.Content.HSG-SRT.D.10 (+) Prove the Laws of Sines and Cosines and use them to solve problems.

CCSS.Math.Content.HSG-SRT.D.11 (+) Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).

Essential Understandings	Content Skills
10-2 to 10-3, Operations can be performed with radical expressions and radical expressions can be simplified using the multiplication and division properties of square roots. 10-4, Some radical equations can be solved by squaring both sides and testing the solutions. 10-5, Square root functions can be graphed by plotting points or using translations of the parent square root function. 10-6, Sine, cosine, and tangent ratios can be used to find the measurements of sides or angles of right triangles.	1.To solve problems using the Pythagorean Theorem 2. To identify right triangles 3. To simplify radicals involving products and quotients 4. To simplify sums and differences of radical expressions 5. To simplify products and quotients of radical expressions 6. To solve equations containing radicals 7. To identify extraneous solutions 8. To graph square root functions 9. To translate graphs of square root functions 10. To find and use trigonometric ratios

Understanding by Design

Essential Questions

1. How are radical expressions represented?
2. What are the characteristics of square root functions?
3. How can you solve a radical equation?

Misconceptions

Operations with Radicals – Students might try to add radicals in a similar manner as radicals can be multiplied.
Radical Equations – Sometimes when solving radical equations, squaring both sides of an equation results in extraneous solutions. They need to check their answers in the original equation.
Trigonometric Ratios - When working with trigonometric ratios it is important to know if the calculator is in degree or radian mode. If students seem to be doing the problem correctly but getting the wrong answer, have them check that their calculator is in the right mode. (TG p. 613B)

Evidence of Learning

Summative Traditional Assessment	Summative Performance Tasks
• Pretest • Quizzes • Chapter tests • Mid-year test • Post-test	• Activities, games, and puzzles • Projects • Daily warm up, Solve It(online) • Got It! • Key Concepts

Formative Assessments

- Class work/Homework
- Student Companion Workbook/note taking
- Practice sheets
- Additional Vocabulary Support
- Enrichment activities
- Oral questioning
- Student demonstration
- Whiteboards
- Standardized test prep

Learning Plan	
Interdisciplinary Connections	Technology Connections
• Concept Bytes • STEM questions focus on Science and Engineering • Problem solving exercises incorporate history, physiology, air travel, construction, etc. • Solve It – Covers a variety of curriculum areas, such as, geography, finance, gaming, etc.	• Smart board Technologies • PowerAlgebra.com • www.calculator.com • Green Globs • Graphing Calculators

Unit Resources
• Student Companion • Online text • Internet • Teacher Resource Materials

New Hanover Township School

Grade: Algebra I (grade 8)

Content Area: Mathematics

Chapter 11

Domain: Arithmetic with Polynomials and Rational Expressions, Reasoning with Equations and Inequalities, and Interpreting Functions

Common Core Standards

Arithmetic with Polynomials and Rational Expressions

Perform arithmetic operations on polynomials.

CCSS.Math.Content.HSA-APR.A.1 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.

Understand the relationship between zeros and factors of polynomials.

CCSS.Math.Content.HSA-APR.B.2 Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number a, the remainder on division by $x – a$ is $p(a)$, so $p(a) = 0$ if and only if $(x – a)$ is a factor of $p(x)$.

CCSS.Math.Content.HSA-APR.B.3 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.

Use polynomial identities to solve problems.

CCSS.Math.Content.HSA-APR.C.4 Prove polynomial identities and use them to describe numerical relationships. *For example, the polynomial identity* $(x^2 + y^2)^2 = (x^2 – y^2)^2 + (2xy)^2$ *can be used to generate Pythagorean triples.*

CCSS.Math.Content.HSA-APR.C.5 (+) Know and apply the Binomial Theorem for the expansion of $(x + y)^n$ in powers of x and y for a positive integer n, where x and y are any numbers, with coefficients determined for example by Pascal's Triangle.[1]

Rewrite rational expressions.

CCSS.Math.Content.HSA-APR.D.6 Rewrite simple rational expressions in different forms; write $^{a(x)}/_{b(x)}$ in the form $q(x) + {}^{r(x)}/_{b(x)}$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$, using inspection, long division, or, for the more complicated examples, a computer algebra system.

CCSS.Math.Content.HSA-APR.D.7 (+) Understand that rational expressions form a system analogous to

the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.

Reasoning with Equations and Inequalities

Understand solving equations as a process of reasoning and explain the reasoning.

CCSS.Math.Content.HSA-REI.A.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.

CCSS.Math.Content.HSA-REI.A.2 Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

Solve equations and inequalities in one variable.

CCSS.Math.Content.HSA-REI.B.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

CCSS.Math.Content.HSA-REI.B.4 Solve quadratic equations in one variable.

CCSS.Math.Content.HSA-REI.B.4a 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.

CCSS.Math.Content.HSA-REI.B.4b Solve quadratic equations by inspection (e.g., for $x^2 = 49$), 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.

Solve systems of equations.

CCSS.Math.Content.HSA-REI.C.5 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.

CCSS.Math.Content.HSA-REI.C.6 Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.

CCSS.Math.Content.HSA-REI.C.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 $x^2 + y^2 = 3$.

CCSS.Math.Content.HSA-REI.C.8 (+) Represent a system of linear equations as a single matrix equation in a vector variable.

CCSS.Math.Content.HSA-REI.C.9 (+) Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3 × 3 or greater).

Represent and solve equations and inequalities graphically.

CCSS.Math.Content.HSA-REI.D.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).

CCSS.Math.Content.HSA-REI.D.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.★

CCSS.Math.Content.HSA-REI.D.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.

Interpreting Functions

Understand the concept of a function and use function notation.

CCSS.Math.Content.HSF-IF.A.1 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 $y = f(x)$.

CCSS.Math.Content.HSF-IF.A.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

CCSS.Math.Content.HSF-IF.A.3 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 $n \geq 1$.*

Interpret functions that arise in applications in terms of the context.

CCSS.Math.Content.HSF-IF.B.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.*★

CCSS.Math.Content.HSF-IF.B.5 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.*★

CCSS.Math.Content.HSF-IF.B.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.★

Analyze functions using different representations.

CCSS.Math.Content.HSF-IF.C.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.★

CCSS.Math.Content.HSF-IF.C.7a Graph linear and quadratic functions and show intercepts, maxima, and minima.

CCSS.Math.Content.HSF-IF.C.7b Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

CCSS.Math.Content.HSF-IF.C.7c Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.

CCSS.Math.Content.HSF-IF.C.7d (+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.

CCSS.Math.Content.HSF-IF.C.7e Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

CCSS.Math.Content.HSF-IF.C.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

CCSS.Math.Content.HSF-IF.C.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.7.

CCSS.Math.Content.HSF-IF.C.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.

CCSS.Math.Content.HSF-IF.C.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.*

Essential Understandings	Content Skills
11-1, The simplest form of a rational expression is like the simplest form of a numerical fraction. The numerator and denominator have no common factor other than 1. To simplify a rational expression, divide out common factors from the numerator and denominator. 11-2 to 11-4, rational expressions and polynomials can be added, subtracted, multiplied, and divided using the same properties used to multiply and divide numerical fractions. 11-5, a rational equation can be solved by first multiplying each side of the equation by the LCD. When each side of a rational equation is a single rational expression, the equation can be solved using the Cross Products Property. 11-6, If the product of two variables is a nonzero constant, then the variables form an inverse variation. 11-7, to graph a rational function f(x), it is necessary to understand the graph's behavior near values of x where the function is undefined.	1. To simplify rational expressions 2. To multiply and divide rational expressions 3. To simplify complex fractions 4. To divide polynomials 5. To add and subtract rational expressions 6. To solve rational equations and proportions 7. To write and graph equations for inverse variations 8. To compare direct and inverse variations 9. To graph rational functions

Understanding by Design

Essential Questions

1. How are rational expressions represented?
2. What are the characteristics of rational functions?
3. How can you solve a rational equation?

Misconceptions

Simplifying Rational Expressions – When finding the domain of rational expressions, it is important to find the zeros of the original denominator. If the simplified form is used, then some excluded values of may be overlooked.
Dividing Polynomials – When dividing a polynomial using the long division algorithm, the dividend must be in standard form and missing terms must be included using coefficients of zero. When missing terms are not included, the problem can become confusing and errors will likely be made.

Evidence of Learning

Summative Traditional Assessment	Summative Performance Tasks
• Pretest • Quizzes • Chapter tests • Mid-year test • Post-test	• Activities, games, and puzzles • Projects • Daily warm up, Solve It(online) • Got It! • Key Concepts

Formative Assessments

- Class work/Homework
- Student Companion Workbook/note taking
- Practice sheets
- Additional Vocabulary Support
- Enrichment activities
- Oral questioning
- Student demonstration
- Whiteboards
- Standardized test prep

Learning Plan

Interdisciplinary Connections	Technology Connections
• Concept Bytes • STEM questions focus on Science and Engineering • Problem solving exercises incorporate history, physiology, air travel, construction, etc. • Solve It – Covers a variety of curriculum areas, such as, geography, finance, gaming, etc.	• Smart board Technologies • PowerAlgebra.com • www.calculator.com • Green Globs • Graphing Calculators

Unit Resources

- Student Companion
- Online text
- Internet
- Teacher Resource Materials

New Hanover Township School

Grade: Algebra I (grade 8)

Content Area: Mathematics

Chapter 12

Domain: Interpreting Categorical and Quantitative data, Making Inferences and Justifying Conclusions, and Conditional Probability and the Rules of Probability

Common Core Standards

Interpreting Categorical and Quantitative Data

Summarize, represent, and interpret data on a single count or measurement variable

CCSS.Math.Content.HSS-ID.A.1 Represent data with plots on the real number line (dot plots, histograms, and box plots).

CCSS.Math.Content.HSS-ID.A.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.

CCSS.Math.Content.HSS-ID.A.3 Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

CCSS.Math.Content.HSS-ID.A.4 Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.

Summarize, represent, and interpret data on two categorical and quantitative variables

CCSS.Math.Content.HSS-ID.B.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.

CCSS.Math.Content.HSS-ID.B.6 Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.

CCSS.Math.Content.HSS-ID.B.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.

CCSS.Math.Content.HSS-ID.B.6b Informally assess the fit of a function by plotting and analyzing residuals.

CCSS.Math.Content.HSS-ID.B.6c Fit a linear function for a scatter plot that suggests a linear association.

Interpret linear models

CCSS.Math.Content.HSS-ID.C.7 Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.

CCSS.Math.Content.HSS-ID.C.8 Compute (using technology) and interpret the correlation coefficient of a linear fit.

CCSS.Math.Content.HSS-ID.C.9 Distinguish between correlation and causation.

Making Inferences and Justifying Conclusions

Understand and evaluate random processes underlying statistical experiments

CCSS.Math.Content.HSS-IC.A.1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population.

CCSS.Math.Content.HSS-IC.A.2 Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. *For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model*?

Make inferences and justify conclusions from sample surveys, experiments, and observational studies

CCSS.Math.Content.HSS-IC.B.3 Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.

Conditional Probability and the Rules of Probability

CCSS.Math.Content.HSS-IC.B.4 Use data from a sample Understand independence and conditional probability and use them to interpret data

CCSS.Math.Content.HSS-CP.A.1 Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” “not”).

CCSS.Math.Content.HSS-CP.A.2 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.

CCSS.Math.Content.HSS-CP.A.3 Understand the conditional probability of *A* given *B* as *P*(*A* and *B*)/*P*(*B*), and interpret independence of *A* and *B* as saying that the conditional probability of *A* given *B* is the same as the probability of *A*, and the conditional probability of *B* given *A* is the same as the probability of *B*.

CCSS.Math.Content.HSS-CP.A.4 Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. *For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.*

CCSS.Math.Content.HSS-CP.A.5 Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. *For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.*

Use the rules of probability to compute probabilities of compound events.

CCSS.Math.Content.HSS-CP.B.6 Find the conditional probability of *A* given *B* as the fraction of *B*'s outcomes that also belong to *A*, and interpret the answer in terms of the model.

CCSS.Math.Content.HSS-CP.B.7 Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B), and interpret the answer in terms of the model.

CCSS.Math.Content.HSS-CP.B.8 (+) Apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B|A) = P(B)P(A|B), and interpret the answer in terms of the model.

CCSS.Math.Content.HSS-CP.B.9 (+) Use permutations and combinations to compute probabilities of compound events and solve problems.

survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.

CCSS.Math.Content.HSS-IC.B.5 Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.

CCSS.Math.Content.HSS-IC.B.6 Evaluate reports based on data.

Essential Understandings	Content Skills
12-1 to 12-4, Data can be organized in matrices or in intervals. Different measures can be used to interpret and compare sets of data. Separating data into subsets is a useful way to summarize and compare data sets. 12-3, different measures can be used to interpret and compare sets of data. 12-5, When collecting data, it is important for the results to accurately represent the situation. 12-6, Counting methods can be used to find the number of possible ways to choose objects with and without regard to order. 12-7 to 12-8, The probability of an event, or P(event), tells how likely it is that the event will occur. Probabilities can be found by reasoning mathematically or by using experimental data. The probability of a compound event can sometimes be found from expressions of the probabilities of simpler events.	1. To organize data in a matrix 2. To add and subtract matrices and multiply a matrix by a scalar 3. To make and interpret frequency tables and histograms 4. To find mean, median, mode, and range 5. To make and interpret box and whisker plots 6. To find quartiles and percentiles 7. To classify data and analyze samples and surveys 8. To find permutations and combinations 9. To find theoretical and experimental probabilities 10. To find probabilities of mutually exclusive and overlapping events 11. To find probabilities of independent and dependent events

Understanding by Design

Essential Questions

1. How can collecting and analyzing data help you make decisions or predictions?
2. How can you make and interpret different representations of data?
3. How is probability related to real-world events?

Misconceptions

Measures of Central Tendency – Without criteria for defining outliers – and students often forget them or do not remember how to find the interquartile – making a determination of any outliers might be subjective. Students might struggle to decide if a value is an outlier and therefore be unsure whether to use mean or median as the measure of central tendency.
Data displays – When choosing intervals to make a frequency table the intervals should not overlap. If students choose overlapping intervals, the table will be incorrect.

Evidence of Learning

Summative Traditional Assessment	Summative Performance Tasks
• Pretest • Quizzes • Chapter tests • Mid-year test • Post-test	• Activities, games, and puzzles • Projects • Daily warm up, Solve It(online) • Got It! • Key Concepts

Formative Assessments

- Class work/Homework
- Student Companion Workbook/note taking
- Practice sheets
- Additional Vocabulary Support
- Enrichment activities
- Oral questioning
- Student demonstration
- Whiteboards
- Standardized test prep

Learning Plan

Interdisciplinary Connections	Technology Connections
• Concept Bytes • STEM questions focus on Science and Engineering • Problem solving exercises incorporate history, physiology, air travel, construction, etc. • Solve It – Covers a variety of curriculum areas, such as, geography, finance, gaming, etc.	• Smart board Technologies • PowerAlgebra.com • www.calculator.com • Green Globs • Graphing Calculators

Unit Resources
• Student Companion • Online text • Internet • Teacher Resource Materials