Grade/Course: Grade 8/9 Algebra I - Data Analysis (Floating Unit)

Standards for Mathematical Practice:

Make sense of problems and persevere in solving them.
Reason abstractly and quantitatively.
Construct viable arguments and critique the reasoning of others.
Model with mathematics.
Use appropriate tools strategically.
Attend to precision.
Look for and make use of structure.
Look for and express regularity in repeated reasoning.

Big Idea: Data Analysis: Data can be modeled and used to make inferences.

Pennsylvania Core Standards:

CC.2.4.HS.B.1
Summarize, represent, and interpret data on a single count or measurement variable.
CC.2.4.HS.B.2
Summarize, represent, and interpret data on two categorical and quantitative variables.
CC.2.4.HS.B.3
Analyze linear models to make interpretations based on the data.
CC.2.4.HS.B.4
Recognize and evaluate random processes underlying statistical experiments.
CC.2.4.HS.B.5
Make inferences and justify conclusions based on sample surveys, experiments, and observational studies.
CC.2.4.HS.B.7
Apply the rules of probability to compute probabilities of compound events in a uniform probability model.

Essential Questions:

- How can we use patterns and data to make predictions?
- How can we use probability and odds to determine if a game is fair or unfair?
- How do we distinguish and determine probabilities for compound events?
- What statistical representation best represents data in a given situation?

Understandings: Students will understand THAT . . .

- There are patterns that can be observed with different display of data.
- Patterns help us to make predictions.
- A game is only fair when there is the same chance of winning and losing.
- Measures of central tendency can be used to characterize a set of data to make predictions.
- A variety of statistical techniques can be use to organize, display and compare sets of data. Understanding that one representation will be better suited than others for given information.

Knowledge:

Vocabulary
- Probability

Skills:

- Determine probability and odds.
- Determine probability for compound events.

- Compound Probability - Odds - Range, quartiles, and interquartile range - Measure of central tendency (Mean, median, mode) - Differences between ways to represent data (line, bar, box and whisker, stem and leaf plots) - Best Fit Line	• Interpret circle, line, bar, stem and leaf plots. • Create and interpret box and whisker. • Draw the line of best fit given a scatterplot and make predictions.

Grade/Course: Grade 8/9 Algebra I – Equivalent Expressions - Exponents

Standards for Mathematical Practice:

Make sense of problems and persevere in solving them.
Construct viable arguments and critique the reasoning of others.
Use appropriate tools strategically.
Look for and make use of structure.
Reason abstractly and quantitatively.
Model with mathematics.
Attend to precision.
Look for and express regularity in repeated reasoning.

Big Idea: Equivalent Expressions: Numbers, measures, expressions, equations, and inequalities can represent mathematical situations and structures in many equivalent forms.

Pennsylvania Core Standards:

2.1.HS.F.1 Apply and extend the properties of exponents to solve problems with rational exponents.

Essential Questions:

- How is simplifying expressions with integer exponents useful?
- How can we decide which property of exponents should be applied in a certain situation?

Understandings: Students will understand THAT . . .

- Properties of numbers and variables allow us to generate equivalent numerical expressions.

Knowledge:

Vocabulary
- exponent
- base
- power
- squared
- cubed

Exponent Properties
Power of a Power
Product of a Power
Power of Products
Quotient of Powers
Power of a Quotient
Zero Exponent Properties
Negative Exponent Properties

Skills:

- Applying exponent properties with expression, radical, and rational expressions and evaluate using:

- Multiplication rules
- Division rules
- Negative exponents
- Exponents of zero

Grade/Course: Grade 8/9 Algebra I - Equivalent Expressions - Polynomials

Standards for Mathematical Practice:

Make sense of problems and persevere in solving them.
Construct viable arguments and critique the reasoning of others.
Use appropriate tools strategically.
Look for and make use of structure.
Reason abstractly and quantitatively.
Model with mathematics.
Attend to precision.
Look for and express regularity in repeated reasoning.

Big Idea: Equivalent Expressions: Numbers, measures, expressions, equations, and inequalities can represent mathematical situations and structures in many equivalent forms.

Pennsylvania Core Standards:

CC.2.2.HS.D.1 Interpret the structure of expressions to represent a quantity in terms of its context.
A1.1.1.5.1, A1.1.1.5.2, A1.1.1.5.3
CC.2.2.HS.D.2 Write expressions in equivalent forms to solve problems.
A1.1.1.5.1, A1.1.1.5.2, A1.1.1.5.3,
CC.2.2.HS.D.3 Extend the knowledge of arithmetic operations and apply to polynomials.
A1.1.1.5.1, A1.1.1.5.2, A1.1.1.5.3
CC.2.2.HS.D.5 Use polynomial identities to solve problems.
A1.1.1.5.1, A1.1.1.5.2, A1.1.1.5.3
CC.2.2.HS.D.6 Extend the knowledge of rational functions to rewrite in equivalent forms.
A1.1.1.5.1, A1.1.1.5.2, A1.1.1.5.3

Essential Questions:

- How does understanding polynomials help me make sense of real world situations?
- How do equivalent representations of expression help me problem solve?

Understandings: Students will understand THAT . . .

- There are different representations for the same expressions.
- Operating on polynomials is a strategy for understanding (or solving) real world situations.

Knowledge:

- Vocabulary:
  -Term
  -Leading Coefficient

Skills:

- Operations with polynomials (+, -, x, ÷)
- Identify: coefficients, constants, terms, linear term, quadratic terms, factors
- Classify by number of terms (ex. polynomial, monomial, binomial, etc.)

-Constant -Monomial -Binomial -Trinomial -Polynomial -Degree of a Polynomial	

Grade/Course: Grade 8/9 Algebra I - Graphing, Writing and Interpreting Linear Equations

Standards for Mathematical Practice:

Make sense of problems and persevere in solving them.
Construct viable arguments and critique the reasoning of others.
Use appropriate tools strategically.
Look for and make use of structure.
Reason abstractly and quantitatively.
Model with mathematics.
Attend to precision.
Look for and express regularity in repeated reasoning.

Big Idea: Linear Equations: Mathematical relations and functions can be modeled through multiple representations and analyzed to raise and answer questions.

Pennsylvania Core Standards:

CC.2.2.8.C.1 Define, evaluate, and compare functions.
CC.2.2.8.C.2 Use concepts of functions to model relationships between quantities.
CC.2.2.HS.C.3 Write functions or sequences that model relationships between two quantities.
CC.2.2.HS.C.5 Construct and compare linear, quadratic and exponential models to solve problems.

Essential Questions:

- How is slope interpreted as a rate of change in real world situations and how does changing the slope and y-intercept change the graph?
- How can we interpret a graph and model it with an equation?

Understandings: Students will understand THAT . . .

- Linear equations can solve problems involving a constant rate of change.
- Changing the slope of a graph will change the inclination and changing the y-intercept will move the line up or down on the y-axis.
- Knowing two points and determining the slope also determines the rate of change and can be applied to all forms of equations.

Knowledge:

Vocabulary:
- Slope
- Y-intercept
- Rate of change
- Slope–intercept form
- Point-slope form
- Standard form
- Parallel/Perpendicular lines
- Coordinate plane

Skills:

Writing equation of line given:
- Slope and y-intercept
- Point and slope
- Two points

Graphing a line from an equation

Grade/Course: Grade 8/9 Algebra I – Equivalent Expressions (Types of Numbers)

Standards for Mathematical Practice:

Make sense of problems and persevere in solving them.
Construct viable arguments and critique the reasoning of others.
Use appropriate tools strategically.
Look for and make use of structure.
Reason abstractly and quantitatively.
Model with mathematics.
Attend to precision.
Look for and express regularity in repeated reasoning.

Big Idea: Equivalent Expressions: Numbers, measures, expressions, equations, and inequalities can represent mathematical situations and structures in many equivalent forms.

Pennsylvania Core Standards:

2.1.8.E.1 Distinguish between rational and irrational numbers using their properties.
2.1.8.E.4 Estimate irrational numbers by comparing them to rational numbers.

Essential Questions:

- What are different ways to represent numbers?
- How are different forms of numbers related?
- Why is generating equivalent expressions worthwhile?

Understandings: Students will understand THAT . . .

- Numbers can be written in multiple ways and still have the same value.
- There is a relationship between rational and irrational numbers.
- The square root of a perfect square is an integer.
- The square root of a non-perfect square lies between two consecutive integers.

Knowledge:

Vocabulary

- Square Roots (w/factor trees)
- Integers
- Rational numbers
- Irrational numbers
- Absolute value of a number
- Cube Roots
- K1 - Perfect Squares (1-144)
- Perfect Cubes (1-125)

Skills:

- Evaluate a square root and determine if we can simplify the square root.
- Rational numbers include integers, fractions, decimals, and percents.
- Irrational numbers include non-repeating decimals.
- Compare and order numbers on a number line. (Irrational and rational numbers)

Grade/Course: Grade 8/9 Algebra I – Inequalities – Graphing and Systems

Standards for Mathematical Practice:

Make sense of problems and persevere in solving them.
Construct viable arguments and critique the reasoning of others.
Use appropriate tools strategically.
Look for and make use of structure.
Reason abstractly and quantitatively.
Model with mathematics.
Attend to precision.
Look for and express regularity in repeated reasoning.

Big Idea: Inequalities: Mathematical relationships among numbers can be represented, compared and communicated.

Pennsylvania Core Standards:

CC.2.2.HS.D.7 Create and graph equations or inequalities to describe numbers or relationships.
CC.2.2.HS.D.10 Represent, solve and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.

Essential Questions:

- Why is graphing the only approach to graphing inequalities?
- How can we compare systems of inequalities to systems of equations?

Understandings: Students will understand THAT . . .

- In a graphical representation of inequalities, the overlapping, shaded regions contain multiple solutions to the problem.
- A system consists of two or more equations or two or more inequalities.
- When two lines intersect the solution is a point, while when two inequalities intersect the solution is a region.

Knowledge:

Vocabulary
- System of inequalities

Skills:

- Solve a system of linear inequalities using the graphing method.
- Write and graph a system of inequalities from a word problem. (linear combinations)
- Determine the shaded region as the solution to the system of inequalities.

Grade/Course: Grade 8/9 Algebra I – Inequalities - Solving

Standards for Mathematical Practice:

Make sense of problems and persevere in solving them.
Construct viable arguments and critique the reasoning of others.
Use appropriate tools strategically.
Look for and make use of structure.
Reason abstractly and quantitatively.
Model with mathematics.
Attend to precision.
Look for and express regularity in repeated reasoning.

Big Idea: Inequalities: Mathematical relationships among numbers can be represented, compared and communicated.

Pennsylvania Core Standards:

CC.2.2.HS.D.7 Create and graph equations or inequalities to describe numbers or relationships.
CC.2.2.HS.D.10 Represent, solve and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.

Essential Questions:

- How can you compare solving an inequality to solving an equation?
- What does it mean in a real world situation to be a solution to an inequality?
- How does putting absolute value signs around an expression affect the way that we solve an inequality?

Understandings: Students will understand THAT . . .

- Inequalities have a range of values that create a true statement.
- Solving an inequality uses the same process as equations.
- In order to keep a true statement the inequality must flip when multiplied or divided by a negative number.
- Absolute value is the distance away from zero that lends itself to having two ranges of solutions.

Knowledge:

Vocabulary and Symbols
- Greater than >
- Greater than or equal to ≥
- Less than <
- Less than or equal to ≤

Absolute Value Inequalities

Skills:

- Solve inequalities using inverse operations.
- Graph the solution on a number line.
- Solve absolute inequalities.
- Graph absolute value inequalities on a number line.

Grade/Course: Grade 8/9 Algebra I – Solving Equations

Standards for Mathematical Practice:

Make sense of problems and persevere in solving them.
Construct viable arguments and critique the reasoning of others.
Use appropriate tools strategically.
Look for and make use of structure.
Reason abstractly and quantitatively.
Model with mathematics.
Attend to precision.
Look for and express regularity in repeated reasoning.

Big Idea: Equations: Mathematical relationships among numbers can be represented, compared and communicated.

Pennsylvania Core Standards:

CC.2.2.8.B.3 Analyze and solve linear equations and pairs of simultaneous linear equations.
CC.2.1.HS.F.4 Use units as a way to understand problems and to guide the solution of multi-step problems.
CC.2.1.HS.F.5 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
CC.2.2.HS.D.2 Write expressions in equivalent forms to solve problems.
A1.1.1.5.1, A1.1.1.5.2, A1.1.1.5.3,
CC.2.2.HS.D.8 Apply inverse operations to solve equations or formulas for a given variable.
CC.2.2.HS.D.10 Represent, solve and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.
CC.2.2.HS.D.9 Use reasoning to solve equations.

Essential Questions:

- What is the best approach to solving equations and how are inverse operations used in that process?
- Does the solution make sense? Why does the solution make sense?
- How can equivalent expressions help us solve problems?
- What does the equal sign between two algebraic expressions represent?
- What is the use of a variable?
- How does putting absolute value signs around an expression affect the way that we solve an equation?

Understandings: Students will understand THAT . . .

- Simplifying equivalent expressions makes problem-solving efficient.
- An equal sign is not an operation, it represents equality on the left and right hand sides of an equation.
- A certain value substituted in for a variable will create equivalent expressions on the left-hand and right-hand sides.
- Absolute value is the distance away from zero that lends itself to having two solutions.

Knowledge:

- Properties used with correct

Skills:

- Able to solve equations for a variable: one-step, two-step, multi-step, variables on both

terminology in solving equations: - Distribution - Commutative - Associative - Identity - Inverse • Absolute Value	sides, using distributive property. • Able to substitute solution back into original equation to make the connection of the expressions being equivalent.

Grade/Course: Grade 8/9 Algebra I – Solving Polynomials and Factoring

Standards for Mathematical Practice:

Make sense of problems and persevere in solving them.
Construct viable arguments and critique the reasoning of others.
Use appropriate tools strategically.
Look for and make use of structure.
Reason abstractly and quantitatively.
Model with mathematics.
Attend to precision.
Look for and express regularity in repeated reasoning.

Big Idea: Numbers, measures, expressions, equations, and inequalities can represent mathematical situations and structures in many equivalent forms.

Pennsylvania Core Standards: 2.2.H.D.1/D.2/D.3/D.5/D.6
CC.2.2.HS.D.2
Write expressions in equivalent forms to solve problems.
A1.1.1.5.1, A1.1.1.5.2, A1.1.1.5.3
CC.2.2.HS.D.6
Extend the knowledge of rational functions to rewrite in equivalent forms.
A1.1.1.5.1, A1.1.1.5.2, A1.1.1.5.3

Essential Questions:

- Why is the factored form of an expression equivalent to the original polynomial?
- How does factoring help us solve a non-linear equation?
- Why do rational expressions have undefined values?

Understandings: Students will understand THAT . . .

- Factoring is the inverse operation of the distributive property.
- Using the zero-product property helps us solve a non-linear equation.
- A denominator in a rational expression can not equal zero, therefore any value that makes it zero is considered excluded making the expression undefined.

Knowledge:

- Vocabulary:
  -Term
  -Leading coefficient
  -Constant
  -Monomial
  -Binomial
  -Trinomial
  -Polynomial

Skills:

- Factor algebraic expressions
  -Greatest Common Factor method
  -Factoring trinomials where a is equal to 1 after factoring out all monomial factors.
  -Difference of squares
- Simplify/reduce a rational algebraic expression involving factoring.
- Identify excluded values in rational expressions.
- Solving trinomials by zero-product property.

-Degree of a polynomial -Factoring -Zeros/Roots of functions -Greatest Common Factor -Least Common Multiple -Zero-Product Property -Difference of Squares -Rational Expression -Excluded Values	

Grade/Course: Grade 8/9 Algebra I - Systems of Equations

Standards for Mathematical Practice:

Make sense of problems and persevere in solving them.
Reason abstractly and quantitatively.
Construct viable arguments and critique the reasoning of others.
Model with mathematics.
Use appropriate tools strategically.
Attend to precision.
Look for and make use of structure.
Look for and express regularity in repeated reasoning.

Big Idea: Systems of Equations: Bivariate data can be modeled with mathematical functions that approximate the data well and help us make predictions based on the data.

Pennsylvania Core Standards:

CC.2.2.HS.D.7
Create and graph equations or inequalities to describe numbers or relationships.
A1.1.2.1.1, A1.1.2.1.2, A1.1.2.1.3, A1.1.3.1.1, A1.1.3.1.2, A1.1.3.1.3, A2.1.3.1.1, A2.1.3.1.2, A2.1.3.1.3, A2.1.3.1.4, A2.2.2.1.1, A2.2.2.1.2, A2.2.2.1.3, A2.2.2.1.4
CC.2.2.HS.D.10
Represent, solve and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.
A1.1.2.1.1, A1.1.2.1.2, A1.1.2.1.3, A1.1.2.2.1, A1.1.2.2.2, A1.1.3.1.1, A1.1.3.1.2, A1.1.3.1.3, A1.1.3.2.1, A1.1.3.2.2, A2.1.3.1.1, A2.1.3.1.2, A2.1.3.1.3, A2.1.3.1.4

Essential Questions:

- What is the best approach to solving the system of equations and what makes one approach better than another?
- What are the characteristics of real world situations that lend themselves to being solved by a system of equations?
- What is a system of equations and what does it mean to solve a system of equations?

Understandings: Students will understand THAT . . .

- Systems of two linear equations can be used to represent two conditions that must be satisfied simultaneously.
- A solution to a system of equations is the intersection point of the two lines. No solution to a system of equations means that the lines do not intersect therefore they are parallel. Infinite solutions to a system of equations means the two equations are identical.
- There are multiple ways to determine the solution to a system of equations (graphing, substitution, elimination).

Knowledge:

Vocabulary

Skills:

- Solve a system of linear equations using the graphing method, substitution method, and

- System of equation - Solution - Infinite Solutions - No solution	elimination method. • Write and solve a system of equations from a word problem. • Determine whether a system of equations has one, none, or infinite solutions. • Write a system of two linear equations that describes a practical situation. • Interpret a solution to a system of equations based on a practical situation. • Identification of which method to use to solve the system of equations.