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Unit Activity Correlations to Common Core State Standards

Algebra 1

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Number and Quantity

The Real Number System

Extend the properties of exponents to rational exponents.

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

Unit 4, Activity 4-3: Operations with Radicals
Unit 4, EA 4-1: Exponential Functions and Radicals

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

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Use properties of rational and irrational numbers.

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.

Unit 1, Activity 1-2: Real Numbers
Unit 1, Activity 1-3: Properties of Real Numbers
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Quantities

Reason quantitatively and use units to solve problems.

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.

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

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

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Unit 6, Activity 6-1: Measures of Center and Spread
Unit 6, Activity 6-2: Random Samples and Estimation
Unit 6, Activity 6-4: Developing a Survey
Unit 6, EA 6-2: Analyzing Results of a Group Project
Unit 6, Unit Practice

Algebra

Seeing Structure in Expressions

Interpret the structure of expressions

1. Interpret expressions that represent a quantity in terms of its context.

a. Interpret parts of an expression, such as terms, factors, and coefficients.

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b. 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.

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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 $(x^2 – y^2)(x^2 + y^2)$.

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Write expressions in equivalent forms to solve problems

3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

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

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Unit 5, Activity 5-4 Solving Quadratic Equations
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b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.

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c. 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%.

Unit 4, Activity 4-2: Exponential Functions
Unit 4, EA 4-1: Exponential Functions and Radicals
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Arithmetic with Polynomials and Rational Expressions

Perform arithmetic operations on polynomials

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.

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Creating Equations

Create equations that describe numbers or relationships

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.

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Unit 2, EA 2-2: Linear Functions and Equations

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

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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.

Unit 2, Activity 2-2: Domain and Range of Continuous Functions
Unit 3, Activity 3-3: Inequalities in Two Variables
Unit 5, Activity 5-1: Introduction to Quadratic Functions

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.

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Unit 2, Activity 2-5: Direct and Inverse Variation
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Unit 3, Activity 3-5: Systems of Linear Equations
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Reasoning with Equations and Inequalities

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

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.

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Solve equations and inequalities in one variable

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

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Unit 2, EA 2-2: Linear Functions and Equations

4. Solve quadratic equations in one variable.

a. 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.

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b. 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 ± bi for real numbers a and b.

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Solve systems of equations

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.

Unit 3, Activity 3-5: Systems of Linear Equations
Unit 3, Activity 3-6: Solving Systems of Linear Systems

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

Unit 3, Activity 3-5: Systems of Linear Equations
Unit 3, Activity 3-6: Solving Systems of Linear Systems
Unit 3, EA 3-2: Systems of Equations and Inequalities
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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 $x^2 + y^2 = 3$.

Unit 5, Activity 5-5: Applying Quadratic Equations
Algebra 2, Unit 3, Activity 3-1: Applications of Quadratic Functions

Represent and solve equations and inequalities graphically

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).

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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.

Unit 3, Activity 3-5: Systems of Linear Equations
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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.

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Functions

Interpreting Functions

Understand the concept of a function and use function notation

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).

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Unit 5, Activity 5-2: Graphing y = ax2 + c
Unit 5, Activity 5-5: Applying Quadratic Equations

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

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Unit 5, Activity 5-1: Introduction to Quadratic Functions
Unit 5, Activity 5-2: Graphing y = ax2 + c

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.

Unit 2, Activity 2-3: Slope as a Rate of Change

Interpret functions that arise in applications in terms of the context

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.

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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.

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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.

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Analyze functions using different representations

7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

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

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

Unit 2, Activity 2-2: Domain and Range of Continuous Functions
Algebra 2, Unit 5, Activity 5-4: Introduction to Rational Functions
Algebra 2, Unit 5, Activity 5-5: Inverse Variation and Rational Functions
Algebra 2, Unit 5, Activity 5-6: Simplifying Rational Expressions
Unit 4, Unit Overview
Unit 4, Activity 4-1: Exponent Rules
Unit 4, Activity 4-2: Exponential Functions
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8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

a. 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.

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Unit 5, Activity 5-4 Solving Quadratic Equations
Unit 5, Activity 5-5: Applying Quadratic Equations
Unit 5, EA 5-2: Solving Quadratic Equations
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b. 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.

Unit 2, Activity 2-2: Domain and Range of Continuous Functions
Unit 4, Unit Overview
Unit 4, Activity 4-1: Exponent Rules
Unit 4, Activity 4-2: Exponential Functions
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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.

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Unit 1, EA 1-3: Inequalities and Absolute Value
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Building Functions

Build a function that models a relationship between two quantities

1. Write a function that describes a relationship between two quantities.

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

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Unit 1, Activity 1-4 Solving Equations with Models
Unit 1, Activity 1-5: Solving Multi-Step Equations
Unit 1, EA 1-2: Properties and Solving Equations
Unit 1, Activity 1-6: Solving Inequalities

b. 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.

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c. 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.

Algebra 2, Unit 1, Activity 1-4: Function Composition and Operations

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

Unit 2, Activity 2-3: Slope as a Rate of Change

Build new functions from existing functions

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

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Unit 5, Activity 5-2: Graphing y = ax2 + c
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4. Find inverse functions.

a. Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. For example, $f(x) = 2x^3$ or $f(x) = (x+1)/(x-1)$ for $x \neq 1$.

Algebra 2, Unit 2, Activity 2-5: Inverse Functions

Linear, Quadratic, and Exponential Models

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

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

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

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

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Unit 3, Math Standards Review

c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

Unit 4, Unit Overview
Unit 4, Activity 4-1: Exponent Rules
Unit 4, Activity 4-2: Exponential Functions
Unit 4, Unit Practice

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).

Unit 2, Activity 2-4: Building a Linear Model
Unit 2, Activity 2-5: Direct and Inverse Variation
Unit 2, EA 2-2: Linear Functions and Equations
Unit 2, Activity 2-6: Slope-Intercept Form
Unit 2, Activity 2-7: x- and y-intercepts
Unit 2, Activity 2-8: Equations from Data
Unit 2, EA 2-3: Linear Equations and Slope as Rate of Change
Unit 2, Unit Practice
Unit 2, Unit Reflection
Unit 2, Math Standards Review
Unit 4, Unit Overview
Unit 4, Activity 4-1: Exponent Rules
Unit 4, Activity 4-2: Exponential Functions
Unit 4, Unit Practice

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.

Unit 4, Unit Overview
Unit 4, Activity 4-1: Exponent Rules
Unit 4, Activity 4-2: Exponential Functions
Unit 4, Unit Practice

Interpret expressions for functions in terms of the situation they model

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

Unit 2, Unit Overview
Unit 2, Activity 2-1: Introduction to Functions
Unit 2, Activity 2-2: Domain and Range of Continuous Functions
Unit 2, EA 2-2: Linear Functions and Equations
Unit 2, Activity 2-7: x- and y-intercepts
Unit 2, EA 2-3: Linear Equations and Slope as Rate of Change
Unit 2, Unit Practice
Unit 2, Unit Reflection
Unit 3, Activity 3-1: Piecewise Linear Functions
Unit 3, Activity 3-2: Equations in Two Variables
Unit 3, EA 3-1: Graphing Inequalities and Piecewise Functions
Unit 3, Unit Practice
Unit 4, Activity 4-2: Exponential Functions
Unit 5, Activity 5-5: Applying Quadratic Equations

Statistics and Probability

Interpreting Categorical and Quantitative Data

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

1. Represent data with plots on the real number line (dot plots, histograms, and box plots).

Unit 1, Activity 1-6: Solving Inequalities
Unit 1, Activity 1-7: Absolute Value
Unit 6, Getting Ready
Unit 6, Activity 6-1: Measures of Center and Spread
Unit 6, EA 6-1: Inferences Based on Data
Unit 6, Activity 6-3: Sampling
Unit 6, Unit Practice

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.

Unit 6, Activity 6-1: Measures of Center and Spread
Unit 6, Activity 6-3: Sampling
Unit 6, EA 6-2: Analyzing Results of a Group Project
Unit 6, Unit Practice

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

Unit 6, Activity 6-1: Measures of Center and Spread
Unit 6, Activity 6-2: Random Samples and Estimation
Unit 6, EA 6-1: Inferences Based on Data
Unit 6, EA 6-2: Analyzing Results of a Group Project
Unit 6, Unit Practice
Unit 6, Math Standards Review

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.

Algebra 2, Unit 6, Activity 6-3: Normal Distribution

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

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.

Unit 2, Unit Overview
Unit 2, Activity 2-8: Equations from Data
Unit 2, Unit Practice
Unit 4, Activity 4-2: Exponential Functions
Unit 6, Getting Ready

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

a. 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.

Unit 2, Activity 2-8: Equations from Data
Unit 2, Unit Practice

b. Informally assess the fit of a function by plotting and analyzing residuals.

Unit 2, Activity 2-8: Equations from Data
Unit 2, Unit Practice

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

Unit 2, Activity 2-8: Equations from Data
Unit 2, Unit Practice

Interpret linear models

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

Unit 2, Unit Overview
Unit 2, Activity 2-3: Slope as a Rate of Change
Unit 2, EA 2-1: Representations of Functions
Unit 2, Activity 2-4: Building a Linear Model
Unit 2, Activity 2-5: Direct and Inverse Variation
Unit 2, EA 2-2: Linear Functions and Equations
Unit 2, Activity 2-6: Slope-Intercept Form
Unit 2, Activity 2-7: x- and y-intercepts
Unit 2, Activity 2-8: Equations from Data
Unit 2, EA 2-3: Linear Equations and Slope as Rate of Change
Unit 2, Unit Practice
Unit 2, Unit Reflection
Unit 2, Math Standards Review
Unit 3, Activity 3-4: Slopes of Parallel and Perpendicular Lines
Unit 3, Activity 3-5: Systems of Linear Equations
Unit 3, Activity 3-6: Solving Systems of Linear Systems
Unit 3, Activity 3-7: Systems of Linear Inequalities
Unit 3, EA 3-2: Systems of Equations and Inequalities

Unit 3, Unit Practice
Unit 3, Unit Reflection
Unit 3, Math Standards Review

8. Compute (using technology) and interpret the correlation coefficient of a linear fit.

Unit 1, Activity 1-6: Linear Relationships

9. Distinguish between correlation and causation.

Unit 2, Activity 2-3: Exponential Function and Graphs
Unit 5, Activity 5-5: Inverse Variation and Rational Functions
Unit 6, Activity 6-4: Data Modeling