

# Number Theory for Algebra

## Learning Objectives

### Concept 1: The Language of Numbers

1. Students learn how natural numbers fit in the number system.
2. Students experience infinite and finite sets of numbers while determining that there is no greatest natural number.
3. Students determine whether a number is even or odd; prime or composite; and square, triangular, or part of the Fibonacci sequence.
4. Students recognize that there is no greatest even number, odd number, prime number, or composite number.

### Concept 2: Factors, Multiples, and Divisors

5. Students learn the language of factors, multiples, and divisors.
6. Students factor numbers into products of prime numbers using conceptually-based procedures.
7. Students identify Greatest Common Factors and Least Common Multiples of two or more numbers.
8. Students use Greatest Common Factors and Least Common Multiples to draw conclusions about contextual situations.

### Concept 3: Working with Algebraic Expressions

9. Students apply their understanding of factoring numerical expressions to factor algebraic expressions.
10. Students simplify rational algebraic expressions using Greatest Common Factors.

# Exponents

## Learning Objectives

### Concept 1: Exponents

1. Students develop and apply the meaning of positive integer exponents in contextual situations involving repeated multiplication.
2. Students understand and use exponential notation, examining differences among expressions, such as  $3^2$  and  $3(2)$  and  $-3^2$ .
3. Students apply the meaning of exponents to both numbers and variables.
4. Students compare and contrast linear growth and exponential growth.

### Concept 2: Properties of Exponents

5. Students identify and generalize patterns within a context to develop properties of exponents.
6. Students recognize patterns to define a zero exponent.
7. Students identify and extend patterns to develop the meaning of negative exponents.
8. Students use properties of exponents to combine and simplify expressions.

### Concept 3: Applications of Exponents

9. Students examine powers of 10 to represent large and small numbers using scientific notation.
10. Students use graphs to explore exponential growth.

# Rational Numbers

## Learning Objectives

### Concept 1: The Various Meanings of Rational Numbers

1. Students learn how rational numbers fit in the number system.
2. Students experience part/whole, quotient, ratio/rate and operator relationships as the different interpretations of rational numbers.
3. Students recognize that rational numbers might be represented as percents and decimals, as well as in fractional form.
4. Students learn the language and notation for rational numbers.
5. Students order and compare rational numbers using number lines, rulers and symbols.
6. Students use part/whole representations, percents and decimals in context.

### Concept 2: Operating on Rational Numbers

7. Students estimate results of operations using models and benchmark numbers.
8. Students explore operations on fractions using conceptually-based models.
9. Students perform operations (  $+$ ,  $-$ ,  $\times$ ,  $\div$  ) with rational numbers in fractional form.
10. Students use models to illustrate operations on fractions.

### Concept 3: Rational Expressions

11. Students apply their understandings of estimation, equivalence and operating on fractional numbers to rational expressions.
12. Students use their understanding of factoring and exponents to operate on rational expressions.

# Equations and Formulas

## Learning Objectives

### Concept 1: The Language of Equations

1. Students learn and use the vocabulary pertaining to expressions and equations.
2. Students recognize the mathematical difference/similarity between expressions and equations.
3. Students understand equality and the function of the equal sign in an equation.
4. Students translate words to symbols and equations (symbols) to words.

### Concept 2: Solving Equations

5. Students use creative strategies to solve equations such as tables, charts, manipulatives and balance scales.
6. Students use the “cover-up” strategy to solving equations and to introduce the notion of “undoing.”
7. Students understand and use the properties of equality to solve one and two step equations.
8. Students solve equations for a specific variable and simplify equations leaving other variables in the solution.

### Concept 3: Formulas

9. Students apply strategies and properties for solving equations to common formulas.
10. Students use the properties of equality to transform formulas and solve for a specified variables.
11. Students explore and use the quadratic formula to find the roots of a quadratic equation.

# Proportional Reasoning

## Learning Objectives

### Concept 1: Introduction to Proportional Reasoning

1. Students distinguish between multiplicative relationships and additive relationships.
2. Students apply their understanding of ratios to reason about proportional (multiplicative) relationships.
3. Students use proportional reasoning to set up and solve problems about various contexts.

### Concept 2: Applying Proportional Reasoning to Percents

4. Students use proportional reasoning to gain a deeper understanding of percents.
5. Students apply their understanding of proportional reasoning to solve contextualized problems involving percents.

### Concept 3: Unit Conversions

6. Students identify unit ratios that compare one unit of measurement to another.
7. Students convert quantities from one unit of measurement to another using conceptually-based procedures.
8. Students complete multi-step unit conversions.

# Data and Probability

## Learning Objectives

### Concept 1: Collecting Data

1. Students discuss appropriate sample sizes and survey techniques for collecting accurate data.
2. Students organize data using bar graphs, circle graphs, pictographs, stem and leaf plots, histograms, and scatter plots.
3. Students use measures of central tendency and range to describe data from various contexts.

### Concept 2: Interpreting Data

4. Students identify patterns in graphs, particularly positive and negative correlations in scatter plots.
5. Students use organizations of data (e.g. graphs) to draw conclusions.

### Concept 3: Probability

6. Students describe probabilities using certain, likely, equally likely, unlikely, and impossible.
7. Students determine ratios and percents that represent probabilities.
8. Students organize sample spaces using tree diagrams, t-charts, and tables.
9. Students compare theoretical and experimental probabilities.
10. Students use their understanding of probabilities to form conclusions by comparing events.
11. Students compare independent and dependent probabilities.