

Indiana Tutorials are designed specifically for the Indiana Academic Standards to prepare students for the Indiana Statewide Testing for Educational Progress-Plus (ISTEP+) End-of-Course Assessments (ECAs).

Math Tutorials offer targeted instruction, practice and review designed to develop computational fluency, deepen conceptual understanding, and apply mathematical practices. They automatically identify and address learning gaps down to elementary-level content, using adaptive remediation to bring students to grade-level no matter where they start. Students engage with the content in an interactive, feedback-rich environment as they progress through standards-aligned modules. By constantly honing the ability to apply their knowledge in abstract and real world scenarios, students build the depth of knowledge and higher order skills required to demonstrate their mastery when put to the test.

In each module, the Learn It and Try It make complex ideas accessible to students through focused content, modeled logic and process, multi-modal representations, and personalized feedback as students reason through increasingly challenging problems. The Review It offers a high impact summary of key concepts and relates those concepts to students' lives. The Test It assesses students' mastery of the module's concepts, providing granular performance data to students and teachers after each attempt. To help students focus on the content most relevant to them, unit-level pretests and posttests can quickly identify where students are strong and where they're still learning.

## 1. REAL NUMBER SYSTEM

### • LAWS OF EXPONENTS

- **AI.RNE.5** Simplify algebraic rational expressions, with numerators and denominators containing monomial bases with integer exponents, to equivalent forms.
- **AI.RNE.3** Rewrite and evaluate numeric expressions with positive rational exponents using the properties of exponents.

### • OPERATIONS ON RATIONAL AND IRRATIONAL NUMBERS

- **AI.RNE.2** 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.
- **AI.RNE.1** Understand the hierarchy and relationships of numbers and sets of numbers within the real number system.

## 2. EQUATIONS AND INEQUALITIES

### • ONE-STEP EQUATIONS AND INEQUALITIES

- **AI.L.2** Represent real-world problems using linear equations and inequalities in one variable and solve such problems. Interpret the solution and determine whether it is reasonable.
- **AI.L.3** Represent real-world and other mathematical problems using an algebraic proportion that leads to a linear equation and solve such problems.
- **AI.L.1** Understand that the steps taken when solving linear equations create new equations that have the same solution as the original. Solve fluently linear equations and inequalities in one variable with integers, fractions, and decimals as coefficients. Explain and justify each step in solving an equation, starting from the assumption that the original equation has a solution. Justify the choice of a solution method.

### • MULTI-STEP EQUATIONS AND INEQUALITIES

- **AI.L.2** Represent real-world problems using linear equations and inequalities in one variable and solve such problems. Interpret the solution and determine whether it is reasonable.
- **AI.L.1** Understand that the steps taken when solving linear equations create new equations that have the same solution as the original. Solve fluently linear equations and inequalities in one variable with integers, fractions, and decimals as

coefficients. Explain and justify each step in solving an equation, starting from the assumption that the original equation has a solution. Justify the choice of a solution method.

- **LITERAL EQUATIONS**

- **AI.L.11** Solve equations and formulas for a specified variable, including equations with coefficients represented by variables.

### 3. WRITING EXPRESSIONS AND EQUATIONS

- **FORMULATING AND SOLVING EQUATIONS FROM WORD PROBLEMS**

- **AI.L.5** Represent real-world problems that can be modeled with a linear function using equations, graphs, and tables; translate fluently among these representations, and interpret the slope and intercepts.
- **AI.L.2** Represent real-world problems using linear equations and inequalities in one variable and solve such problems. Interpret the solution and determine whether it is reasonable.

- **FORMULATING AND SOLVING INEQUALITIES FROM WORD PROBLEMS**

- **AI.L.2** Represent real-world problems using linear equations and inequalities in one variable and solve such problems. Interpret the solution and determine whether it is reasonable.

### 4. FUNCTIONS

- **FUNCTIONS AND RELATIONS**

- **AI.F.4** Understand and interpret statements that use function notation in terms of a context; relate the domain of the function to its graph and to the quantitative relationship it describes.
- **AI.F.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. Understand that 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  $x$ . Understand the graph of  $f$  is the graph of the equation  $y = f(x)$ .

- **DOMAIN AND RANGE**

- **AI.F.3** Identify the domain and range of relations represented in tables, graphs, verbal descriptions, and equations.
- **AI.F.4** Understand and interpret statements that use function notation in terms of a context; relate the domain of the function to its graph and to the quantitative relationship it describes.
- **AI.F.2** Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear, has a maximum or minimum value). Sketch a graph that exhibits the qualitative features of a function that has been verbally described. Identify independent and dependent variables and make predictions about the relationship.

### 5. GRAPHS OF LINEAR EQUATIONS AND INEQUALITIES

- **SLOPE**

- **AI.F.2** Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear, has a maximum or minimum value). Sketch a graph that exhibits the qualitative features of a function that has been verbally described. Identify independent and dependent variables and make predictions about the relationship.
- **AI.L.5** Represent real-world problems that can be modeled with a linear function using equations, graphs, and tables; translate fluently among these representations, and interpret the slope and intercepts.
- **AI.F.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. Understand that 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  $x$ . Understand the graph of  $f$  is the graph of the equation  $y = f(x)$ .

- **GRAPHING AND ANALYZING LINEAR FUNCTIONS**

- **AI.F.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. Understand that 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  $x$ . Understand the graph of  $f$  is the graph of the equation  $y = f(x)$ .
- **AI.F.2** Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear, has a maximum or minimum value). Sketch a graph that exhibits the qualitative features of a function that has been verbally described. Identify independent and dependent variables and make predictions about the relationship.
- **AI.L.4** Represent linear functions as graphs from equations (with and without technology), equations from graphs, and equations from tables and other given information (e.g., from a given point on a line and the slope of the line).
- **AI.L.5** Represent real-world problems that can be modeled with a linear function using equations, graphs, and tables; translate fluently among these representations, and interpret the slope and intercepts.
- **AI.F.3** Identify the domain and range of relations represented in tables, graphs, verbal descriptions, and equations.
- **AI.F.4** Understand and interpret statements that use function notation in terms of a context; relate the domain of the function to its graph and to the quantitative relationship it describes.

#### • SOLVING SYSTEMS OF LINEAR INEQUALITIES

- **AI.L.7** Represent real-world problems using linear inequalities in two variables and solve such problems; interpret the solution set and determine whether it is reasonable. Solve other linear inequalities in two variables by graphing.
- **AI.SEI.4** Represent real-world problems using a system of two linear inequalities in two variables and solve such problems; interpret the solution set and determine whether it is reasonable. Solve other pairs of linear inequalities by graphing with and without technology.

## 6. LINEAR EQUATIONS

#### • SLOPE-INTERCEPT FORM OF A LINEAR EQUATION

- **AI.F.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. Understand that 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  $x$ . Understand the graph of  $f$  is the graph of the equation  $y = f(x)$ .
- **AI.L.5** Represent real-world problems that can be modeled with a linear function using equations, graphs, and tables; translate fluently among these representations, and interpret the slope and intercepts.
- **AI.F.2** Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear, has a maximum or minimum value). Sketch a graph that exhibits the qualitative features of a function that has been verbally described. Identify independent and dependent variables and make predictions about the relationship.
- **AI.L.6** Translate among equivalent forms of equations for linear functions, including slope-intercept, point-slope, and standard. Recognize that different forms reveal more or less information about a given situation.

#### • POINT-SLOPE FORM OF A LINEAR EQUATION

- **AI.F.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. Understand that 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  $x$ . Understand the graph of  $f$  is the graph of the equation  $y = f(x)$ .
- **AI.L.4** Represent linear functions as graphs from equations (with and without technology), equations from graphs, and equations from tables and other given information (e.g., from a given point on a line and the slope of the line).
- **AI.L.5** Represent real-world problems that can be modeled with a linear function using equations, graphs, and tables; translate fluently among these representations, and interpret the slope and intercepts.
- **AI.L.6** Translate among equivalent forms of equations for linear functions, including slope-intercept, point-slope, and standard. Recognize that different forms reveal more or less information about a given situation.

## 7. TWO-VARIABLE LINEAR SYSTEMS

#### • SOLVING SYSTEMS OF LINEAR EQUATIONS: GUESS AND CHECK

- **AI.SEI.3** Write a system of two linear equations in two variables that represents a real-world problem and solve the problem

with and without technology. Interpret the solution and determine whether the solution is reasonable.

- **AI.SEI.1** Understand the relationship between a solution of a pair of linear equations in two variables and the graphs of the corresponding lines. Solve pairs of linear equations in two variables by graphing; approximate solutions when the coordinates of the solution are non-integer numbers.

- **SOLVING SYSTEMS OF LINEAR EQUATIONS: GRAPHING**

- **AI.SEI.3** Write a system of two linear equations in two variables that represents a real-world problem and solve the problem with and without technology. Interpret the solution and determine whether the solution is reasonable.
- **AI.SEI.1** Understand the relationship between a solution of a pair of linear equations in two variables and the graphs of the corresponding lines. Solve pairs of linear equations in two variables by graphing; approximate solutions when the coordinates of the solution are non-integer numbers.

- **SOLVING SYSTEMS OF LINEAR EQUATIONS: SUBSTITUTION**

- **AI.SEI.3** Write a system of two linear equations in two variables that represents a real-world problem and solve the problem with and without technology. Interpret the solution and determine whether the solution is reasonable.
- **AI.SEI.2** Understand 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. Solve pairs of linear equations in two variables using substitution and elimination.

- **SOLVING SYSTEMS OF LINEAR EQUATIONS: ELIMINATION**

- **AI.SEI.3** Write a system of two linear equations in two variables that represents a real-world problem and solve the problem with and without technology. Interpret the solution and determine whether the solution is reasonable.
- **AI.SEI.2** Understand 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. Solve pairs of linear equations in two variables using substitution and elimination.

## 8. EXPONENTIAL FUNCTIONS, EQUATIONS, AND INEQUALITIES

- **EXPONENTIAL FUNCTIONS**

- **AI.QE.3** Graph exponential and quadratic equations in two variables with and without technology.
- **AI.F.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. Understand that 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  $x$ . Understand the graph of  $f$  is the graph of the equation  $y = f(x)$ .
- **AI.QE.1** Distinguish between situations that can be modeled with linear functions and with exponential functions. Understand that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. Compare linear functions and exponential functions that model real-world situations using tables, graphs, and equations.
- **AI.F.3** Identify the domain and range of relations represented in tables, graphs, verbal descriptions, and equations.
- **AI.F.4** Understand and interpret statements that use function notation in terms of a context; relate the domain of the function to its graph and to the quantitative relationship it describes.
- **AI.QE.2** Represent real-world and other mathematical problems that can be modeled with exponential functions using tables, graphs, and equations of the form  $y = ab^x$  (for integer values of  $x > 1$ , rational values of  $b > 0$  and  $b \neq 1$ ); translate fluently among these representations and interpret the values of  $a$  and  $b$ .

- **EXPONENTIAL GROWTH AND DECAY**

- **AI.QE.2** Represent real-world and other mathematical problems that can be modeled with exponential functions using tables, graphs, and equations of the form  $y = ab^x$  (for integer values of  $x > 1$ , rational values of  $b > 0$  and  $b \neq 1$ ); translate fluently among these representations and interpret the values of  $a$  and  $b$ .
- **AI.QE.1** Distinguish between situations that can be modeled with linear functions and with exponential functions. Understand that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. Compare linear functions and exponential functions that model real-world situations using tables, graphs, and

equations.

- **AI.QE.3** Graph exponential and quadratic equations in two variables with and without technology.

- **SOLVING EXPONENTIAL INEQUALITIES**

- **AI.QE.2** Represent real-world and other mathematical problems that can be modeled with exponential functions using tables, graphs, and equations of the form  $y = ab^x$  (for integer values of  $x > 1$ , rational values of  $b > 0$  and  $b \neq 1$ ); translate fluently among these representations and interpret the values of  $a$  and  $b$ .
- **AI.L.7** Represent real-world problems using linear inequalities in two variables and solve such problems; interpret the solution set and determine whether it is reasonable. Solve other linear inequalities in two variables by graphing.

## 9. POLYNOMIALS

- **POLYNOMIAL BASICS**

- **AI.RNE.7** Understand polynomials are closed under the operations of addition, subtraction, and multiplication with integers; add, subtract, and multiply polynomials and divide polynomials by monomials.

- **ADDITION AND SUBTRACTION OF POLYNOMIALS**

- **AI.RNE.7** Understand polynomials are closed under the operations of addition, subtraction, and multiplication with integers; add, subtract, and multiply polynomials and divide polynomials by monomials.

- **MULTIPLICATION OF POLYNOMIALS**

- **AI.RNE.7** Understand polynomials are closed under the operations of addition, subtraction, and multiplication with integers; add, subtract, and multiply polynomials and divide polynomials by monomials.

## 10. FACTORING

- **FACTORING QUADRATIC TRINOMIALS**

- **AI.RNE.6** Factor common terms from polynomials and factor polynomials completely. Factor the difference of two squares, perfect square trinomials, and other quadratic expressions.
- **AI.QE.4** Solve quadratic equations in one variable by inspection (e.g., for  $x^2 = 49$ ), finding square roots, using the quadratic formula, and factoring, as appropriate to the initial form of the equation.

- **FACTORING SPECIAL CASES**

- **AI.RNE.6** Factor common terms from polynomials and factor polynomials completely. Factor the difference of two squares, perfect square trinomials, and other quadratic expressions.

## 11. GRAPHS OF QUADRATIC FUNCTIONS

- **QUADRATIC FUNCTIONS**

- **AI.F.2** Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear, has a maximum or minimum value). Sketch a graph that exhibits the qualitative features of a function that has been verbally described. Identify independent and dependent variables and make predictions about the relationship.
- **AI.QE.5** Represent real-world problems using quadratic equations in one or two variables and solve such problems with and without technology. Interpret the solution and determine whether it is reasonable.

- **ANALYZING GRAPHS OF QUADRATIC FUNCTIONS**

- **AI.F.3** Identify the domain and range of relations represented in tables, graphs, verbal descriptions, and equations.
- **AI.F.4** Understand and interpret statements that use function notation in terms of a context; relate the domain of the function to its graph and to the quantitative relationship it describes.

- **AI.F.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. Understand that 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  $x$ . Understand the graph of  $f$  is the graph of the equation  $y = f(x)$ .
- **AI.F.2** Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear, has a maximum or minimum value). Sketch a graph that exhibits the qualitative features of a function that has been verbally described. Identify independent and dependent variables and make predictions about the relationship.
- **AI.QE.3** Graph exponential and quadratic equations in two variables with and without technology.
- **AI.QE.4** Solve quadratic equations in one variable by inspection (e.g., for  $x^2 = 49$ ), finding square roots, using the quadratic formula, and factoring, as appropriate to the initial form of the equation.

- **REPRESENTATIONS OF QUADRATIC FUNCTIONS**

- **AI.F.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. Understand that 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  $x$ . Understand the graph of  $f$  is the graph of the equation  $y = f(x)$ .
- **AI.F.2** Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear, has a maximum or minimum value). Sketch a graph that exhibits the qualitative features of a function that has been verbally described. Identify independent and dependent variables and make predictions about the relationship.
- **AI.QE.3** Graph exponential and quadratic equations in two variables with and without technology.
- **AI.QE.5** Represent real-world problems using quadratic equations in one or two variables and solve such problems with and without technology. Interpret the solution and determine whether it is reasonable.
- **AI.QE.6** Use the process of factoring to determine zeros, lines of symmetry, and extreme values in real-world and other mathematical problems involving quadratic functions; interpret the results in the real-world contexts.
- **AI.QE.7** Describe the relationships among the solutions of a quadratic equation, the zeros of the function, the  $x$ -intercepts of the graph, and the factors of the expression.

## 12. SOLVING QUADRATIC FUNCTIONS

- **SOLVING QUADRATIC EQUATIONS BY FACTORING**

- **AI.QE.4** Solve quadratic equations in one variable by inspection (e.g., for  $x^2 = 49$ ), finding square roots, using the quadratic formula, and factoring, as appropriate to the initial form of the equation.
- **AI.QE.6** Use the process of factoring to determine zeros, lines of symmetry, and extreme values in real-world and other mathematical problems involving quadratic functions; interpret the results in the real-world contexts.
- **AI.RNE.6** Factor common terms from polynomials and factor polynomials completely. Factor the difference of two squares, perfect square trinomials, and other quadratic expressions.
- **AI.F.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. Understand that 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  $x$ . Understand the graph of  $f$  is the graph of the equation  $y = f(x)$ .
- **AI.QE.3** Graph exponential and quadratic equations in two variables with and without technology.
- **AI.QE.5** Represent real-world problems using quadratic equations in one or two variables and solve such problems with and without technology. Interpret the solution and determine whether it is reasonable.

- **QUADRATIC FORMULA**

- **AI.QE.4** Solve quadratic equations in one variable by inspection (e.g., for  $x^2 = 49$ ), finding square roots, using the quadratic formula, and factoring, as appropriate to the initial form of the equation.
- **AI.F.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. Understand that 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  $x$ . Understand the graph of  $f$  is the graph of the equation  $y = f(x)$ .
- **AI.QE.5** Represent real-world problems using quadratic equations in one or two variables and solve such problems with and without technology. Interpret the solution and determine whether it is reasonable.

## 13. NONLINEAR FUNCTIONS

### • LINEAR VERSUS NONLINEAR FUNCTIONS

- **AI.QE.1** Distinguish between situations that can be modeled with linear functions and with exponential functions. Understand that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. Compare linear functions and exponential functions that model real-world situations using tables, graphs, and equations.
- **AI.QE.3** Graph exponential and quadratic equations in two variables with and without technology.
- **AI.L.5** Represent real-world problems that can be modeled with a linear function using equations, graphs, and tables; translate fluently among these representations, and interpret the slope and intercepts.
- **AI.F.2** Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear, has a maximum or minimum value). Sketch a graph that exhibits the qualitative features of a function that has been verbally described. Identify independent and dependent variables and make predictions about the relationship.

### • ABSOLUTE VALUE FUNCTIONS

- **AI.F.3** Identify the domain and range of relations represented in tables, graphs, verbal descriptions, and equations.
- **AI.F.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. Understand that 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  $x$ . Understand the graph of  $f$  is the graph of the equation  $y = f(x)$ .
- **AI.F.2** Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear, has a maximum or minimum value). Sketch a graph that exhibits the qualitative features of a function that has been verbally described. Identify independent and dependent variables and make predictions about the relationship.
- **AI.L.10** Graph absolute value linear equations in two variables.

## 14. STATISTICAL DESIGN AND ANALYSIS

### • ANALYZING STATISTICAL SAMPLES

- **AI.DS.1** Distinguish between random and non-random sampling methods, identify possible sources of bias in sampling, describe how such bias can be controlled and reduced, evaluate the characteristics of a good survey and well-designed experiment, design simple experiments or investigations to collect data to answer questions of interest, and make inferences from sample results.
- **AI.DS.6** Understand that statistics and data are non-neutral and designed to serve a particular interest. Analyze the possibilities for whose interest might be served and how the representations might be misleading.

### • CONCLUSIONS IN DATA

- **AI.DS.1** Distinguish between random and non-random sampling methods, identify possible sources of bias in sampling, describe how such bias can be controlled and reduced, evaluate the characteristics of a good survey and well-designed experiment, design simple experiments or investigations to collect data to answer questions of interest, and make inferences from sample results.

## 15. STATISTICS

### • FREQUENCY TABLES

- **AI.DS.5** Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns (including joint, marginal, and conditional relative frequencies) to describe possible associations and trends in the data.

### • SCATTERPLOTS

- **AI.DS.2** Graph bivariate data on a scatter plot and describe the relationship between the variables.

- **AI.DS.4** Distinguish between correlation and causation.
- **AI.DS.3** Use technology to find a linear function that models a relationship for a bivariate data set to make predictions; interpret the slope and  $y$ -intercept, and compute (using technology) and interpret the correlation coefficient.

- **SCATTERPLOTS AND MODELING**

- **AI.DS.2** Graph bivariate data on a scatter plot and describe the relationship between the variables.
- **AI.DS.3** Use technology to find a linear function that models a relationship for a bivariate data set to make predictions; interpret the slope and  $y$ -intercept, and compute (using technology) and interpret the correlation coefficient.