

## **Sixth Grade Mathematics**

### **A - Ratio and Proportional Relationships**

- 1) explain the meaning of and use ratio language to describe a ratio relationship between two quantities
- 2) explain the concept of a unit rate  $a/b$  associated with a ratio  $a:b$  with  $b \neq 0$ , and use rate language in the context of a ratio relationship
- 3) solve percent problems by determining the whole, the part, or the percent using proportional reasoning
- 4) convert one unit of measurement to another measurement unit by using proportional relationships (customary and metric)
- 5) use manipulatives, create tables of equivalent ratios, or draw pictures such as fraction strips or tape diagrams to solve problems involving proportional relationships
- 6) describe, analyze, and generalize patterns and sequences from function rules, tables, and graphs including finding missing values and plotting ordered pairs on the coordinate plane

### **B - The Number System**

- 7) compute and interpret quotients of fractions using visual fraction models to solve word problems
- 8) compute multi-digit decimal and whole number problems fluently in all four operations
- 9) determine the greatest common factor of two whole numbers less than or equal to 100
- 10) determine the least common multiple of two whole numbers less than or equal to 12
- 11) use the distributive property to express a sum of two whole numbers 1-100 with a common factor as the multiple of two whole numbers with no common factor
- 12) model and demonstrate that all positive and negative numbers represent quantities that have opposite directions or values
- 13) represent positive and negative numbers as quantities in real world contexts, explaining the meaning of zero in each situation
- 14) identify and graph rational numbers as points on a number line
- 15) plot numbers of opposite signs to indicate locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself
- 16) graph the reflection of an ordered pair by changing the signs of its coordinates
- 17) understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane
- 18) determine the absolute value of a number and understand it as the distance from zero on a number line
- 19) distinguish comparisons of absolute value from statements about order
- 20) write, interpret, order, and explain statements of order for rational numbers in real world contexts
- 21) use coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate
- 22) determine the prime factorization of a composite number

### **C - Expressions and Equations**

- 23) write and evaluate numerical expressions involving whole-number exponents by applying order of operations
- 24) write and evaluate algebraic expressions, including those with exponents, and solve simple one-step equations using each of the four basic operations
- 25) identify one or more parts of an algebraic expression as a single entity using mathematical terms (sum, term, product, factor, quotient, coefficient)
- 26) identify a variable as a letter that represents an unknown quantity in an algebraic expression
- 27) apply the properties of operations to generate equivalent expressions involving one or more variables
- 28) identify when two expressions are equivalent (e.g., when the two expressions name the same number regardless of which value is substituted into them)
- 29) use substitution to determine whether a given number in a specified set makes an equation or inequality true

## Proposed Mathematics AKS for 2012-2013

- 30) use variables to represent numbers and write expressions when solving a real world or mathematical problem
- 31) solve real world and mathematical problems by writing and solving one-step linear equations, in the form  $x + p = q$ , using each of the four basic operations in which all values are nonnegative rational numbers
- 32) write an inequality in one variable to represent a constraint or condition in a real-world or mathematical problem
- 33) interpret infinite solutions to inequalities in problem contexts and represent solutions on number line diagrams
- 34) represent, describe, and analyze relationships between independent and dependent variables using tables, graphs, and formulas

### **D - Geometry**

- 35) determine the areas of composite figures by composing into rectangles and decomposing them into triangles and other shapes
- 36) apply the formulas  $V=bh$  and  $V=lwh$  to compute and solve real-world and mathematical problems involving right rectangular prisms
- 37) draw polygons in the coordinate plane given coordinates for the vertices
- 38) use a polygon's coordinates to find the vertical or horizontal side lengths of the figure as applied to real-world and mathematical problems
- 39) represent three-dimensional figures using nets made up of rectangles and triangles
- 40) estimate and calculate surface area of three-dimensional figures using nets of rectangles and triangles in the context of real world problems

### **E - Statistics and Probability**

- 41) develop and identify statistical questions used to collect data with variability
- 42) describe and analyze a set of data collected to answer a statistical question based on measures of central tendency, identifying the center, spread, and overall shape of the distribution
- 43) contrast a measure of center with a measure of variation for a numerical set
- 44) display, read, and analyze data using appropriate graphs, including box-and-whisker plots, scatter plots, histograms, and line plots
- 45) analyze and summarize data sets in context by describing the measured attribute, measures of center and variability, the number of observations, patterns, and deviations from a pattern

### **TB - Number and Operations in Base Ten**

- 46) use whole number exponents to denote powers of 10

### **TC - Number and Operations-Fraction**

- 47) solve real world problems involving multiplication of fractions and mixed numbers by using visual fraction models or equations to represent the problem

## **Seventh Grade Mathematics**

### **A - Ratios and Proportional Relationships**

- 1) calculate unit rates associated with complex fractions, including ratios of lengths, areas, and other quantities measured in like or different units
- 2) determine whether two quantities are in a proportional relationship
- 3) recognize and represent proportional relationships between quantities
- 4) identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships
- 5) explain what a point  $(x, y)$  on the graph of a proportional relationship means in terms of the situation, with special attention to the points  $(0, 0)$  and  $(1, r)$  where  $r$  is the unit rate
- 6) use proportional relationships to solve multi-step ratio and percent problems

### **B - The Number System**

- 7) add, subtract, multiply, divide, and solve real world problems using positive and negative rational numbers, including fractions, decimals, and integers
- 8) convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats
- 9) divide integers provided that the divisor is not zero and every quotient of integers is a rational number

### **C - Expressions and Equations**

- 10) add, subtract, factor, and expand linear expressions with rational coefficients
- 11) interpret solutions of algebraic expressions and equations in problem contexts
- 12) justify the reasonableness of results using various estimation strategies
- 13) use variables to represent quantities in a real world or mathematical problem
- 14) represent, write, and solve an equation or inequality and interpret the solution for a given real world problem
- 15) represent a given situation using an inequality in one variable
- 16) use the properties of inequality in one variable to solve inequalities
- 17) graph the solutions to inequalities on a number line and interpret within the problem context

### **D - Geometry**

- 18) solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale
- 19) construct geometric shapes with given conditions, including constructing triangles from three measures of angles or sides and determining which measurements produce a unique triangle
- 20) sketch, model, and describe a cross section of two-dimensional figures, right rectangular prisms, and right rectangular pyramids
- 21) analyze, explain, and solve problems involving the relationship of the circumference of a circle, its diameter, and  $\pi$
- 22) compute and solve problems involving the area of a circle by partitioning, tiling, and using a formula
- 23) determine an informal derivation of the relationship between the circumference and the area of a circle
- 24) write and solve equations for an unknown angle in a figure using facts about supplementary, complementary, vertical, and adjacent angles
- 25) compute and solve real world problems involving area of two-dimensional figures composed of triangles and quadrilaterals, and volume of right prisms
- 26) compute and solve real world problems involving surface area of right rectangular prisms

## Proposed Mathematics AKS for 2012-2013

### **E - Statistics and Probability**

- 27) explain how a random sample is used to improve the chance of selecting a representative sample and supports valid inferences
- 28) generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions
- 29) draw inferences from a random sample about a population with an unknown characteristic of interest
- 30) compare and contrast multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions
- 31) compare and contrast the degree of visual overlap of two numerical data distributions with similar variabilities, informally measuring the difference between the centers by expressing it as a multiple of a measure of variability (mean absolute deviation)
- 32) analyze data using measures of central tendency (mean, median, and mode)
- 33) analyze data with respect to measure of variation (range, interquartile range, and recognition of outliers)
- 34) use probabilities to predict the likelihood of an event (between zero and one) and represent the probability as a ratio
- 35) explain how experimental probability approaches theoretical probability when the number of trials is large
- 36) collect data on a probability event and observe its long-run relative frequency
- 37) conduct trials/simulations and analyze the relationship between experimental and theoretical probability
- 38) compare probabilities from a model to observed frequencies and explain possible sources of discrepancy, if present
- 39) develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events
- 40) develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process
- 41) represent sample spaces using tree diagrams, lists, simulations, and tables to identify the outcomes in the sample space which compose the event
- 42) determine the probability of compound simple events
- 43) explain that a compound event is the fraction of outcomes in the sample space for which the compound event occurs
- 44) design and use simulation to generate frequencies for compound events

### **TB - The Number System**

- 45) identify and graph rational numbers as points on a number line
- 46) write, interpret, order, and explain statements of order for rational numbers in real world contexts
- 47) determine the absolute value of a number and understand it as the distance from zero on a number line

### **TC - Expressions and Equations**

- 48) apply the properties of operations to generate equivalent expressions involving one or more variables
- 49) use variables to represent numbers and write expressions when solving a real world or mathematical problem
- 50) write an inequality in one variable to represent a constraint or condition in a real-world or mathematical problem
- 51) interpret infinite solutions to inequalities in problem contexts and represent solutions on number line diagrams

### **TE - Statistics and Probability**

- 52) describe and analyze a set of data collected to answer a statistical question based on measures of central tendency and describe the center, spread, and overall shape of the distribution
- 53) display, read, and analyze data using appropriate graphs, including box-and-whisker plots, scatter plots, histograms, and line plots
- 54) analyze and summarize data sets in context by describing the measured attribute, measures of center and variability, the number of observations, patterns, and deviations from a pattern

## **Eighth Grade Mathematics**

### **A - The Number System**

- 1) distinguish between rational and irrational numbers, such that rational numbers are those with decimal expansions that terminate in zeros or eventually repeat, and that all other numbers are called irrational
- 2) recognize square roots as points and as lengths on a number line in order to compare the size of irrational numbers

### **B - Expressions and Equations**

- 3) apply properties to simplify expressions containing integer exponents
- 4) calculate small square roots of perfect squares and cube roots of small perfect cubes
- 5) express and use numbers in scientific notation to estimate very large or very small numbers
- 6) compare numbers in scientific notation and determine how many times greater one value is to another
- 7) perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used
- 8) interpret and use scientific notation and choose units of appropriate size for measurements of very large or very small quantities
- 9) graph proportional relationships, interpreting the unit rate as the slope of the graph
- 10) compare two different proportional relationships represented as verbal, tabular, graphic and algebraic representations of functions
- 11) determine the meaning of slope by using similar right triangles to explain why the slope  $m$  is the same between any two distinct points on a non-vertical line in the coordinate plane
- 12) derive and graph linear equations in slope intercept form  $y = mx + b$
- 13) present and solve linear equations both algebraically and graphically, including examples of linear equations in one variable with one solution, infinitely many solutions or no solutions
- 14) solve linear equations with rational number coefficients, including equations whose solutions require expanding using the distributive property and combining like terms
- 15) solve systems of equations algebraically and estimate solutions by graphing the equations
- 16) correspond points of intersection of graphs to solutions to a system of two linear equations in two variables because points of intersection satisfy both equations simultaneously
- 17) solve real world mathematical problems leading to two linear equations in two variables

### **C - Functions**

- 18) describe and identify a function as a correspondence between inputs and outputs where each input has exactly one output
- 19) describe functions in a variety of representations, including the graph of a function that is the set of ordered pairs consisting of an input and the corresponding output
- 20) compare properties of two functions each represented among verbal, tabular, graphic and algebraic representations of functions
- 21) describe relations and functions as linear, (including  $y = mx + b$ ), and nonlinear
- 22) determine the equation of a line by constructing a function to model a relationship between two quantities
- 23) determine and interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values
- 24) create a graph that exhibits the qualitative features of the function that has been described verbally
- 25) compare and contrast qualitatively between relations that are functions and by analyzing a graph

### **D - Geometry**

- 26) model and verify the properties of basic translations, dilations, rotations, reflections, and relate symmetry to appropriate transformations

## Proposed Mathematics AKS for 2012-2013

### **D – Geometry (*continued*)**

- 27) recognize a two-dimensional figure as congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations
- 28) describe a sequence of transformations, that when given, proves congruences between two figures
- 29) determine the coordinates resulting from translations, dilations, rotations or reflections when given a figure in the coordinate plane
- 30) recognize that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations and dilations
- 31) describe a sequence of transformations, that when given, proves similarity between two figures
- 32) apply properties of angle pairs formed by parallel lines cut by a transversal
- 33) analyze and establish facts about the angle sum and exterior angle of triangles, and the angle-angle criterion for similarity of triangles
- 34) recognize and interpret the Pythagorean Theorem, and its converse, as a statement about the areas of squares on the sides of a right triangle
- 35) apply properties of right triangles, including the Pythagorean Theorem, in real world and mathematical problems within two- and three-dimensional figures
- 36) explain and apply the distance formula as an application of the Pythagorean Theorem
- 37) solve real world and mathematical problems involving the volume of cylinders, cones and spheres

### **E - Statistics and Probability**

- 38) gather data that can be modeled with a linear function to investigate patterns of association between two quantities
- 39) construct and interpret scatter plots for bivariate measurements
- 40) describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association
- 41) estimate and determine the line of best fit from a scatter plot and informally assess the accuracy of the model by judging the closeness of the data points to the line
- 42) apply the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting slope and intercept
- 43) recognize that patterns of association can be seen in bivariate categorical data by displaying frequencies and relative frequencies in a table
- 44) construct and interpret a table summarizing data on two categorical variables collected from the same subjects
- 45) use relative frequencies calculated for rows or columns to describe possible association between the two variables

### **TB - Expressions and Equations**

- 46) write an inequality in one variable to represent a constraint or condition in a real-world or mathematical problem
- 47) interpret infinite solutions to inequalities in problem contexts and represent solutions on number line diagrams
- 48) interpret solutions of algebraic expressions and equations in problem contexts
- 49) write and solve algebraic equations and inequalities in one variable including those involving absolute values
- 50) represent a given situation using an inequality in one variable
- 51) use the properties of inequality in one variable to solve inequalities
- 52) graph the solutions to inequalities on a number line and interpret within the problem context

### **TE - Statistics and Probability**

- 53) represent sample spaces using tree diagrams, lists, simulations, and tables to identify the outcomes in the sample space which compose the event
- 54) determine the probability of compound simple events