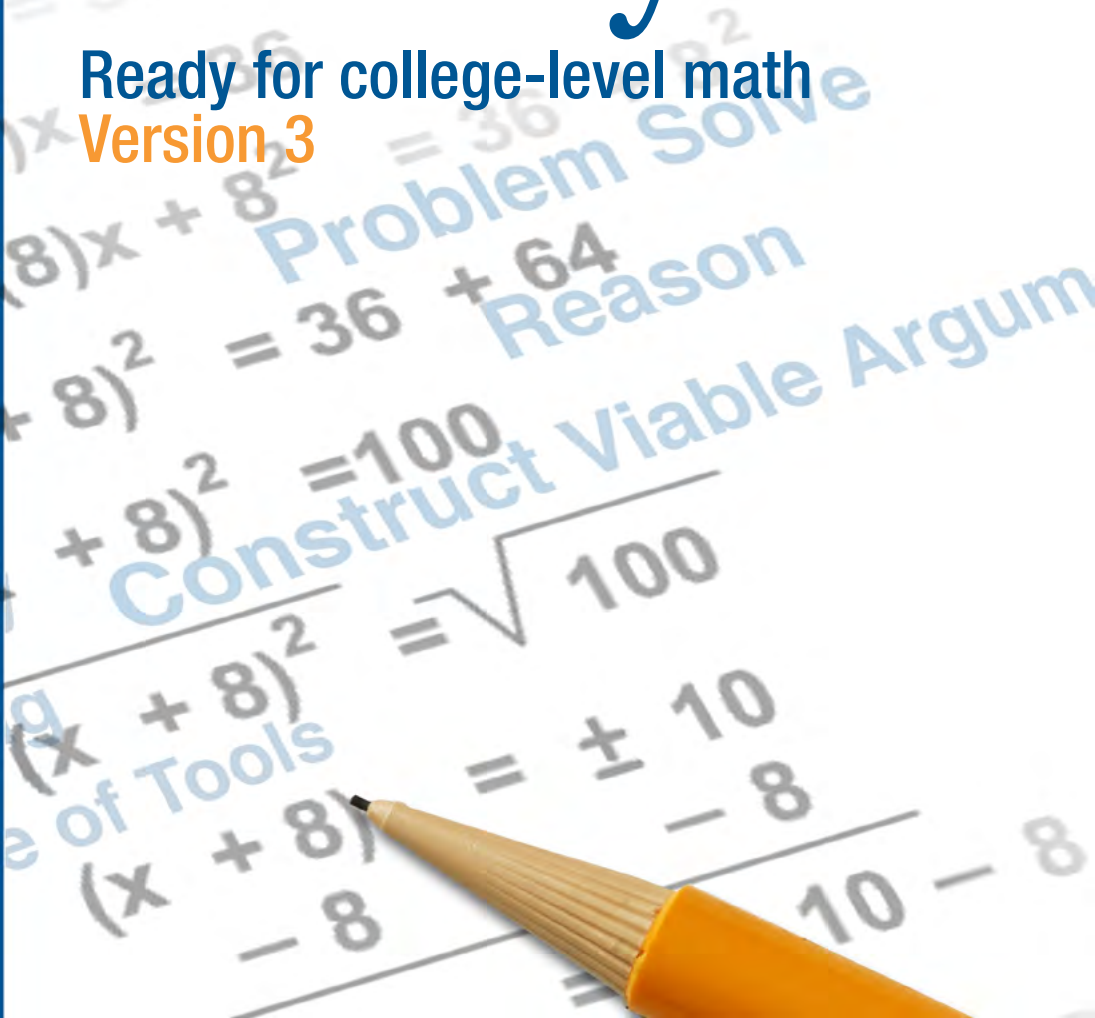
SREB

SREB Readiness Courses
Transitioning to college and careers

Math Ready

Ready for college-level math
Version 3



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Introduction
SREB Readiness Courses

SREB has worked for over a decade with states to introduce policies and programs that address the issue of too many students graduating from high school not prepared for success in the college classroom or workplace. For states that wish to close the readiness gap, SREB has developed two sets of readiness courses in literacy and mathematics. The Ready for College courses are designed to give underprepared students a solid foundation for success in college and postsecondary training. The Ready for High School courses offer an earlier intervention, reaching underprepared students as they enter high school, which for many students is the most critical time in their education in determining future success.

Ready for College Courses: Prepared for College and Careers

By implementing senior-year courses in literacy and mathematics for underprepared students, schools can give students the foundation they need for success in postsecondary studies. SREB offers two courses, *Literacy Ready* and *Math Ready*, designed to prepare students for college before they graduate from high school. These courses are being implemented in thousands of high schools across the nation, and are available as a free download from www.sreb.org/readiness-courses-literacy-math.

Math Ready

This course emphasizes an understanding of math concepts, as opposed to memorizing facts. Math Ready students learn the context behind procedures and come to understand why to use a certain formula or method to solve a problem. By engaging students in real-world applications, this course develops critical thinking skills that students will use in college and careers.

The course consists of eight units: algebraic expressions, equations, measurement and proportional reasoning, linear functions, systems of linear equations, quadratic functions, exponential functions, and statistics.

Unit 1: Algebraic Expressions

The algebraic expressions unit was designed to solidify student understanding of expressions while providing the students with an opportunity to have success early in the course. The recurring theme integrated in this unit focuses on engaging students using and expanding the concepts found within purposefully chosen activities. Through guided lessons, students will manipulate, create and analyze algebraic expressions and look at the idea of whether different sets of numbers are closed under certain operations. The writing team selected content familiar to the students in this unit to build student confidence and to acclimate students to the course's intended approach to instruction.

Unit 2: Equations

The equations unit calls for students to construct and evaluate problems that involve one or two steps while seeking understanding of how and why equations and inequalities are used in their daily lives. Students are also asked to use the structure of word problems and equations to rewrite and solve equations in different forms revealing different relationships.

Unit 3: Measurement and Proportional Reasoning

This unit deals with unit conversions, using proportions for scaling, and area and volume. It requires higher-order thinking and number sense in order to get to the true intent of the standards covered. It is useful in helping students make connections with math and science or other subjects.

Unit 4: Linear Functions

This unit takes students back to the foundation of all high school mathematics—an in-depth study of linear functions. Along with allowing students to differentiate between relations that are functions and those that are not, the unit helps students specifically examine characteristics of linear functions. By looking closely at linear functions in multiple forms, students are expected to graph and write equations, as well as interpret their meaning in context of the slope and y-intercept. Students conclude with a project allowing them to collect their own data and write a line of best fit from that data.

Unit 5: Linear Systems of Equations

The systems unit deals with solving systems of linear equations. This involves helping students classify solutions (one, none or infinitely many), as well as set up and solve problems using systems of equations. This unit also asks students to choose the best way to solve a system of equations and be able to explain their solutions.

Unit 6: Quadratic Functions

Unit 6 is an expansive look at quadratic functions: their graphs, tables and algebraic functions. It stresses multiple approaches to graphing, solving and understanding quadratics, as students explore, make conjectures and draw conclusions in group-work settings. In this unit, students explore and learn from multiple applications of quadratics. The unit assumes students have seen quadratics before but may not have a concrete, transferrable understanding of quadratic functions. The unit does not cover algebraic manipulations (multiplying and factoring), as these are in earlier units.

Unit 7: Exponential Functions

This unit develops students' fluency in exponential functions through varying real-life financial applications/inquiries. The unit builds student understanding of these higher-level functions and gives them the opportunity to reflect upon the ramifications of their future financial choices.

Unit 8: Summarizing and Interpreting Statistical Data (optional)

In this unit students further develop skills to read, analyze, and communicate (using words, tables, and graphs) relationships and patterns found in data sets of one or more variables. Learning how to choose the appropriate statistical tools and measurements to assist in the analysis, being able to clearly communicate results either in words, graphs, or tables, and being able to read and interpret graphs, measurements, and formulas are crucial skills to have in a world overflowing with data. Students explore these concepts while modeling real contexts based on data they collect.

Math Ready Content Standards

Number and Operations

Reason quantitatively and use units to solve problems.

- NO.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.
- NO.2: Define appropriate quantities for the purpose of descriptive modeling.

Expressions and Equations

Understand the connections between proportional relationships, lines, and linear equations.

- EE.1: Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways.
- EE.2: Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equations y=mx for a line through the origin and the equation y=mx+b for a line intercepting the vertical axis at b.

Analyze and solve linear equations and pairs of simultaneous linear equations.

- EE.3: Solve linear equations in one variable.

Algebra

Interpret the structure of expressions.

- A.1: Interpret expressions that represent a quantity in terms of its context.
- A.2: Use the structure of an expression to identify ways to rewrite it.

Write expressions in equivalent forms to solve problems.

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

Create equations that describe numbers or relationships.

- A.4: Create equations and inequalities in one variable and use them to solve problems.
- A.5: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
- A.6: Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable on non-viable options in a modeling context.
- A.7: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.

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

- A.8: 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.
- A.9: Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

Solve equations and inequalities in one variable.

- A.10: Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
- A.11: Solve quadratic equations in one variable.

Solve systems of equations.

- A.12: 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.
- A.13: Solve systems of linear equations exactly and approximately, focusing on pairs of linear equations in two variables.
- A.14: Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.

Represent and solve equations and inequalities graphically.

- A.15: 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.
- A.16: 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.

Functions

Define, evaluate and compare functions.

- F.1: Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and corresponding output.
- F.2: Compare properties of two functions each represented in a different way (algebraically, graphically numerically in tables, or by verbal descriptions).
- F.3: Interpret the equation y=mx+b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear.

Use functions to model relationships between quantities.

- F.4: Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship of from two (x,y) values, including reading these from a table or from a graph. 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.

Interpret functions that arise in application in terms of the context.

- F.5: For a function that models a relationship between two quantities, interpret key features of the graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.

Analyze functions using different representations.

- F.6: Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.
- F.7: Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
- F.8: Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions.

Build a function that models a relationship between two quantities.

- F.9: Write a function that describes a relationship between two quantities.
- F.10: Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.

Build new functions from existing functions.

- F.11: Identify the effect on the graph of replacing f(x) by f(x)+k, kf(x), f(kx), and f(x+k) for specific vales of k (both positive and negative); find the value of k given the graphs.

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

- F.12: Distinguish between situations that can be modeled with linear functions and with exponential functions.
- F.13: 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).
- F.14: Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.

Interpret expressions for functions in terms of the situation they model.

- F.15: Interpret the parameters in a linear or exponential function in terms of a context.

Geometry & Spatial Sense

Use coordinates to prove simple geometric theorems algebraically.

- G.1: Use coordinates to prove simple geometric theorems algebraically.
- G.2: Use coordinates to compute perimeters of polygons and areas of triangles and rectangles.

Explain volume formulas and use them to solve problems.

- G.3: Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid and cone.
- G.4: Use volume formulas for cylinders, pyramids, cones and spheres to solve problems.

Apply geometric concepts in modeling situations.

- G.5: Apply concepts of density based on area and volume in modeling situations.
- G.6: Apply geometric methods to solve design problems.

Data Analysis and Statistics

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

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

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

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

- S.4: 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.
- S.5: Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.

Interpret linear models.

- S.6: Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.
- S.7: Compute (using technology) and interpret the correlation coefficient of a linear fit.
- S.8: Distinguish between correlation and causation.

Understand and evaluate random processes underlying statistical experiments.

- S.9: Understand statistics as a process for making inferences about population parameters based on a random sample from that population.

Make inferences and justify conclusions from sample surveys, experiments and observational studies.

- S.10: Recognize the purposes of and differences among sample surveys, experiments and observational studies; explain how randomization relates to each.

SREB Process Readiness Indicators:

- PRI 1: Make sense of problems and persevere in solving through reasoning and exploration.
- PRI 2: Reason abstractly and quantitatively by using multiple forms of representations to make sense of and understand mathematics.
- PRI 3: Describe and justify mathematical understandings by constructing viable arguments, critiquing the reasoning of others and engaging in meaningful mathematical discourse.
- PRI 4: Contextualize mathematical ideas by connecting them to real-world situations. Model with mathematics.
- PRI 5: Use appropriate tools strategically to support thinking and problem solving.
- PRI 6: Attend to precision.
- PRI 7: Look for and make use of patterns and structure.
- PRI 8: Look for and express regularity in repeated reasoning.
- PRI 9: Demonstrate flexible use of strategies and methods while reflecting on which procedures seem to work best for specific types of problems.
- PRI 10: Reflect on mistakes and misconceptions to improve mathematical understanding.