Common Core State Standards
At-a-Glance Transition Documents
Eighth Grade

S^{2}TEM Centers SC
www.s2temsc.org

S^{2}TEM Centers SC are a statewide system of support for improving instruction and increasing student achievement in mathematics and science. S²TEM Centers SC, like S²MART Centers before them, are an initiative of South Carolina's Coalition for Mathematics and Science. The S^{2}TEM Centers SC seek to work collaboratively with STEM-oriented partners in education, business and government.

SOUTH CAROLINA'S COALITION FOR MATHEMATICS & SCIENCE
SCCMS
- ACHIEVEMENT BY DESIGN -

Preface

The S^{2}TEM Centers SC At-a-Glance Transition Documents were created in response to a request by district leaders for a quick overview of the magnitude of the changes as South Carolina moves from the 2007 SC Academic Standards for Mathematics to the Common Core State Standards for Mathematics (CCSSM). These documents do not provide a detailed analysis of the CCSSM or include all of the sub-skills that might need to be taught to ensure mastery of the standard, nor do they replace the current Support Documents for Mathematics that is available for Kindergarten through Algebra 1. More robust instructional resources will be created as SC gets closer to full implementation of the CCSSM.

In addition to the S^{2}TEM Centers SC At-a-Glance Transition Documents, educators should have copies of the CCSSM from www.corestandards.org, as well as the appendices that accompany the standards. Specifically, K-8 educators will need access to the CCSSM glossary which includes tables 1, 2, and 3 to completely understand the intent of the standards.

The format of the documents is:

- Bulleted list of content that is new to the given grade level
- Bulleted list of content that is no longer included in the standards for the given grade level
- Four column table showing: Common Core State Standard, Understanding CCSS: Notes and Examples, 2007 SC Academic Standard, Major Changes

Throughout this document, the Common Core State Standards are identified by grade level, domain, and standard number. So, for example, 3.NBT.2 refers to the 3rd grade Number and Operations in Base Ten standard #2.

Please note: The CCSSM identifies a list of 8 Standards for Mathematical Practice in addition to the content standards for each grade. These mathematical practices are similar to NCTM's Process Standards. The Standards for Mathematical Practice identify the "habits of mind" used by proficient mathematics students. They are: (1) Make sense of problems and persevere in solving them, (2) Reason abstractly and quantitatively, (3) Construct viable arguments and critique the reasoning of others, (4) Model with mathematics, (5) Use appropriate tools strategically, (6) Attend to precision, (7) Look for and make use of structure, (8) Look for and express regularity in repeated reasoning.

As with any curriculum document, the S^{2}TEM Center SC At-a-Glance Transition Documents are updated regularly to ensure accuracy of information. The date of the most recent edits is noted in the footer on each page of the documents. Please contact the S^{2}TEM Centers SC CCSSM team at ccss.s2temsc@gmail.com with edits, refinements, and questions. Thank you.

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Acknowledgements

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Grade 8 Overview

In Grade 8, instructional time should focus on three critical areas: (1) formulating and reasoning about expressions and equations, including modeling an association in bivariate data with a linear equation, and solving linear equations and systems of linear equations; (2) grasping the concept of a function and using functions to describe quantitative relationships; (3) analyzing two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and understanding and applying the Pythagorean Theorem.

The Number System

- Know that there are numbers that are not rational, and approximate them by rational numbers.

Expressions and Equations

- Work with radicals and integer exponents.
- Understand the connections between proportional relationships, lines, and linear equations.
- Analyze and solve linear equations and pairs of simultaneous linear equations.

Functions

- Define, evaluate, and compare functions.
- Use functions to model relationships between quantities.

Geometry

- Understand congruence and similarity using physical models, transparencies, or geometry software.
- Understand and apply the Pythagorean Theorem.
- Solve real-world and mathematical problems involving volume of cylinders, cones and spheres.

Statistics and Probability

- Investigate patterns of association in bivariate data.

Common Core State Standards Initiative. (2010). Common Core State Standards for Mathematics. Washington, DC: National Governors Association Center for Best Practices and the Council of Chief State School Officers.

EIGHTH GRADE CHANGES AT-A-GLANCE

What content is New to 8th Grade?

- Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number. (8.NS-1)
- Know and apply the properties of integer exponents to generate equivalent numerical expressions. (8.EE-1)
- Use numbers expressed in the form of a single digit times a whole-number power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. (8.EE-3)
- Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities. Interpret scientific notation that has been generated by technology. (8.EE-4)
- Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. (8.EE-5)
- Analyze and solve pairs of simultaneous linear equations. (8.EE-8)
- 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 the corresponding output. (8.F-1)
- Describe qualitatively the functional relationship between two quantities by analyzing a graph. Sketch a graph that exhibits the qualitative features of a function that has been described verbally. (8.F-5)
- Verify experimentally the properties of rotations, reflections, and translations. (8.G-1)
- Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them. (8.G-2)
- Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. (8.G-5)
- Explain a proof of the Pythagorean Theorem and its converse. (8.G-6)
- Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. (8.SP-3)
- 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 to describe possible association between the two variables. (8.SP-4)

Note: The Common Core State Standards are identified by grade level, domain, and standard number. So, for example, 8.NS.1 refers to the 8th grade Number System standard #1.

EIGHTH GRADE CHANGES AT-A-GLANCE

What content will no longer be included in the 8th Grade Standards?*

- Apply an algorithm to add, subtract, multiply, and divide integers. (8-2.1)
- Understand the effect of multiplying and dividing a rational number by another rational number. (8-2.2)
- Apply the concept of absolute value. (8-2.5)
- Apply ratios, rates, and proportions. (8-2.7)
- Use commutative, associative, and distributive properties to examine the equivalence of a variety of algebraic expressions. (8-3.3)
- Use ordered pairs, equations, intercepts, and intersections to locate points and lines in a coordinate plane. (8-4.2)
- Use proportional reasoning and the properties of similar shapes to determine the length of a missing side. (8-5.1)
- Explain the effect on the area of two-dimensional shapes and on the volume of three-dimensional shapes when one or more of the dimensions are changed. (8-5.2)
- Apply formulas to determine the exact (*pi*) circumference and area of a circle. (8-5.4)
- Apply formulas to determine the perimeters and areas of trapezoids. (8-5.5)
- Analyze a variety of measurement situations to determine the necessary level of accuracy and precision. (8-5.6)
- Use multistep unit analysis to convert between and within U.S. Customary System and the metric system. (8-5.7)
- Organize data in matrices or scatterplots as appropriate. (8-6.2)
- Use theoretical and experimental probability to make inferences and convincing arguments about an event or events. (8-6.3)
- Apply procedures to calculate the probability of two dependent events. (8-6.4)
- Interpret the probability for two dependent events. (8-6.5)
- Apply procedures to compute the odds of a given event. (8-6.6)
- Analyze probability using area models. (8-6.7)
- Interpret graphic and tabular data representations by using range and the measures of central tendency (mean, median, and mode). (8-6.8)

Note: Common Core standards implementation will begin in 2010-2011, with full implementation and assessment in 2014-2015.

EIGHTH GRADE

THE NUMBER SYSTEM (NS)

Common Core State Standards	Understanding CCSS: Notes and Examples	2007 S.C. Academic Standards for Mathematics	Major Changes
8.NS – Know that there are numbers that are not rational, and approximate them by rational numbers.			
1. Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.			This standard is new to 8^{th} grade.
2. Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π^2).	For example, by truncating the decimal expansion of $\sqrt{2}$, show that $\sqrt{2}$ is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.	8-2.3 Represent the approximate location of irrational numbers on a number line. 8-2.4 Compare rational and irrational numbers by using the symbols $\underline{<}$, $\underline{>}$, <, >, and =.	None noted.

EIGHTH GRADE

EXPRESSIONS AND EQUATIONS (EE)

Common Core State Standards	Understanding CCSS: Notes and Examples	2007 S.C. Academic Standards for Mathematics	Major Changes
8.EE – Work with radicals and integer exponents.			
1. Know and apply the properties of integer exponents to generate equivalent numerical expressions.	For example, $3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27$.		This standard is new to 8th grade. (See 2007 EA-2.2 for reference)
2. Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.		8-2.6 Apply strategies and procedures to approximate between two whole numbers and the square roots or cube roots of numbers less than 1,000.	Extend to include solving equations of the form $x^2 = p$ and $x^3 = p$. (See 2007 7-2.10 for reference)
3. Use numbers expressed in the form of a single digit times a whole-number power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other.	For example, estimate the population of the United States as 3×10^9, and determine that the world population is more than 20 times larger.		This standard is new to 8th grade. (See 2007 7-2.7 for reference and extend to include expressing how many times as much one is than the other)
4. Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for			This standard is new to 8th grade. (See 2007 EA-2.3 for reference)

measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.			
8.EE – Understand the connections between proportional relationships, lines, and linear equations.			
5. Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways.	For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.		This standard is new to 8th grade (See 2007 7-3.6 and 7-3.7 for reference and extend to include interpreting the unit rate as slope and comparing two different proportional relationships)
6. 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 equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at *b*.	NOTE: This is the first time students are introduced to the concept of slope in CCSS. Reference CCSS Glossary (slope)	8-3.7 Identify the slope of a linear equation from a graph, equation, and/or table. 8-3.1 Translate among verbal, graphic, tabular, and algebraic representations of linear functions.	Extend to include using similar triangles to understand that the slope of a line is the same between any two points on that line.

8.EE – Analyze and solve linear equations and pairs of simultaneous linear equations.			
7. Solve linear equations in one variable. a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers). b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.		8-3.4 Apply procedures to solve multistep equations.	Extend to include equations with infinitely many solutions or no solutions. (See 2007 EA-4.7 for reference) Extend to include solving equations with rational number coefficients.

8. Analyze and solve pairs of simultaneous linear equations. a. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously. b. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. c. Solve real-world and mathematical problems leading to two linear equations in two variables.	For example, $3x + 2y = 5$ and $3x + 2y = 6$ have no solution because $3x + 2y$ cannot simultaneously be 5 and 6. For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.		This standard is new to 8^{th} grade. (See 2007 EA-4.9 and EA-4.10 for reference)

EIGHTH GRADE

FUNCTIONS (F)

Common Core State Standards	Understanding CCSS: Notes and Examples	2007 S.C. Academic Standards for Mathematics	Major Changes
8.F – Define, evaluate, and compare functions.			
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 the corresponding output.	Note: Function notation is not required in Grade 8.		This standard is new to 8th grade. (See 2007 EA-3.1 for reference)
2. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).	For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.	8-3.1 Translate among verbal, graphic, tabular, and algebraic representations of linear functions.	Extend to include comparisons of two functions and include comparisons of both linear and nonlinear functions.
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.	For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1, 1), (2, 4), and (3, 9), which are not on a straight line.	8-3.5 Classify relationships between two variables in graphs, tables, and/or equations as either linear or nonlinear.	(See 2007 EA-5.6 for reference)

8.F – Use functions to model relationships between quantities.			
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 or 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.		8-3.2 Represent algebraic relationships with equations and inequalities. 8-3.6 Identify the coordinates of the *x*- and *y*- intercepts of a linear equation from a graph, equation, and/or table. 8-3.7 Identify the slope of a linear equation from a graph, equation, and/or table.	Extend to include understanding the connections between what x-intercepts, y-intercepts and slope are in the context of a given problem. (See 2007 EA-4.1, EA-4.2 and EA-4.3 for reference)
5. Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.			This standard is new to 8th grade.

EIGHTH GRADE

GEOMETRY (G)

Common Core State Standards	Understanding CCSS: Notes and Examples	2007 S.C. Academic Standards for Mathematics	Major Changes
8.G – Understand congruence and similarity using physical models, transparencies, or geometry software.			
1. Verify experimentally the properties of rotations, reflections, and translations: a. Lines are taken to lines, and line segments to line segments of the same length. b. Angles are taken to angles of the same measure. c. Parallel lines are taken to parallel lines.			This standard is new to 8th grade. (See 2007 6-4.5 and 7-4.1 for reference)
2. Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.			This standard is new to 8th grade. (See 2007 6-4.5 and 7-4.1 for reference)
3. Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.		8-4.4 Analyze the effect of a dilation on a square, rectangle, or right triangle in a coordinate plane.	Extend to include effects of translations, rotations and reflections. (See 2007 6-4.6 for reference)

4. Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; give two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.		8-4.3 Apply a dilation to a square, rectangle, or right triangle in a coordinate plane. 8-4.4 Analyze the effect of a dilation on a square, rectangle, or right triangle in a coordinate plane.	Extend to include the converse of these two standards. Extend to include sequences of transformations. (See 2007 7-4.7 for reference)
5. Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles.	For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.		This standard is new to 8th grade. (See 2007 7-4.5, G-2.2, G-3.6, and the "similarity" portion of G-3.9 for reference)
8.G – Understand and apply the Pythagorean Theorem.			
6. Explain a proof of the Pythagorean Theorem and its converse.			This standard is new to 8th grade. (See 2007 G-3.10 for reference)
7. Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.		8-4.1 Apply the Pythagorean theorem.	Extend to include real-world problems involving three dimensions.
8. Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.		8-4.1 Apply the Pythagorean theorem.	Extend to include finding distance.
8.G – Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.			

9. Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.		8-5.3 Apply strategies and formulas to determine the volume of the three-dimensional shapes cone and sphere.	Extend to include knowing the formula for finding the volume of a cylinder. (See 2007 7-5.2 for reference)

EIGHTH GRADE

STATISTICS AND PROBABILITY (SP)

Common Core State Standards	Understanding CCSS: Notes and Examples	2007 S.C. Academic Standards for Mathematics	Major Changes
8.SP – Investigate patterns of association in bivariate data.			
1. Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.		8-6.1 Generalize the relationship between two sets of data by using scatterplots and lines of best fit.	None noted. Reference CCSS Glossary (bivariate)
2. Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.		8-6.1 Generalize the relationship between two sets of data by using scatterplots and lines of best fit.	None noted.
3. Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept.	For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.		This standard is new to 8th grade.
4. Understand that patterns of	For example, collect data from		This standard is new to 8th grade.

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 to describe possible association between the two variables.	students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?		