Chapter 111. Texas Essential Knowledge and Skills for Mathematics
Subchapter B. Middle School

§111.28. Grade 8

(a) Introduction.

(1) The ***desire to achieve educational excellence*** is the driving force behind the Texas essential knowledge and skills for mathematics, guided by the college and career readiness standards. By embedding statistics, probability, and finance, while focusing on computational thinking, mathematical fluency and solid understanding, Texas will lead the way in mathematics education and prepare all Texas students for the challenges they will face in the 21st century.

(2) The ***process standards*** describe ways in which students are expected to engage in the content. The placement of the process standards at the beginning of the knowledge and skills listed for each grade and course is intentional. The process standards weave the other knowledge and skills together so that students may be successful problem solvers and use mathematics efficiently and effectively in daily life. The process standards are integrated at every grade level and course. When possible,

- students will apply mathematics to problems arising in everyday life, society, and the workplace.
- Students will use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution.
- Students will select appropriate tools such as real objects, manipulatives, algorithms, paper and pencil, and technology and techniques such as mental math, estimation, and number sense, and generalization and abstraction to solve problems.
- Students will effectively communicate mathematical ideas, reasoning, and their implications using multiple representations such as symbols, diagrams, graphs, computer programs, and language.
- Students will use mathematical relationships to generate solutions and make connections and predictions.
- Students will analyze mathematical relationships to connect and communicate mathematical ideas.
- Students will display, explain, or justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

(3) The ***primary focal areas*** in Grade 8 are
- proportionality;
- expressions, equations, relationships, and foundations of functions;
- and measurement and data.

Students use concepts, algorithms, and properties of real numbers to explore mathematical relationships and to describe increasingly complex situations. Students use concepts of proportionality to explore, develop, and communicate mathematical relationships. Students use algebraic thinking to describe how a change in one quantity in a relationship results in a change in the other. Students connect verbal, numeric, graphic, and symbolic representations of relationships, including equations and inequalities. Students begin to develop an understanding of functional relationships. Students use geometric properties and relationships, as well as spatial reasoning, to model and analyze situations and solve problems. Students communicate information about geometric figures or situations by quantifying attributes, generalize procedures from measurement experiences, and use the procedures to solve problems. Students use appropriate statistics, representations of data, and reasoning to draw conclusions, evaluate arguments, and make recommendations. While the use of all types of technology is important, the emphasis on algebra readiness skills necessitates the implementation of graphing technology.

(b) Knowledge and skills.

Mathematical Process Standards	Reporting Category 1: Numerical Representations and Relationships	Reporting Category 2: Computations and Algebraic Relationships	Reporting Category 3: Geometry and Measurement	Reporting Category 4: Data Analysis and Personal Financial Literacy
These student expectations will NOT be listed under a separate reporting category. Instead, they will be incorporated into test questions across reporting categories since the application of mathematical process standards is part of each knowledge statement. **8.1** The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to: (A) **_apply_** mathematics to problems arising in everyday life, society, and the workplace; (B) **_use_** a problem-solving model that incorporates **_analyzing_** given information, **_formulating_** a plan or strategy, **_determining_** a solution, **_justifying_** the solution, and e**_valuating_** the problem-solving process and the	The student will demonstrate an understanding of how to represent and manipulate numbers and expressions. **8.2** The student applies mathematical process standards to represent and use real numbers in a variety of forms. The student is expected to: (A) **_extend_** previous knowledge of sets and subsets using a visual representation **_to describe_** relationships between sets of real numbers; (B) **_approximate_** the value of an irrational number, including π and square roots of numbers less than 225, **_and locate_** that rational number approximation on a number line; (C) **_convert_** between standard decimal notation and scientific notation; and (D) **_order_** a set of real numbers arising from mathematical and real-world contexts.	The student will demonstrate an understanding of how to perform operations and represent algebraic relationships. **8.4** The student applies mathematical process standards to explain proportional and non-proportional relationships involving slope. The student is expected to: (A) **_use_** similar right triangles to develop an understanding that slope, m, given as the rate comparing the change in y-values to the change in x-values, $(y_2 - y_1) / (x_2 - x_1)$, is the same for any two points (x_1, y_1) and (x_2, y_2) on the same line; (B) **_graph_** proportional relationships, **_interpreting_** the unit rate as the slope of the line that models the relationship; and (C) **_use_** data from a table or graph **_to determine_** the rate of change or slope and y-intercept in mathematical and real-world problems. **8.5** The student applies mathematical process standards to use proportional and non-proportional relationships to develop foundational concepts of functions. The student is expected to: (A) **_represent_** linear proportional situations with tables, graphs, and equations in the form of $y = kx$; (B) **_represent_** linear non-proportional situations with tables, graphs, and equations in the form of $y = mx + b$, where $b \neq 0$; (E) **_solve_** problems involving direct variation;	The student will demonstrate an understanding of how to represent and apply geometry and measurement concepts. **8.3** The student applies mathematical process standards to use proportional relationships to describe dilations. The student is expected to: (A) **_generalize_** that the ratio of corresponding sides of similar shapes are proportional, including a shape and its dilation; (B) **_compare and contrast_** the attributes of a shape and its dilation(s) on a coordinate plane; and (C) **_use_** an algebraic representation **_to explain_** the effect of a given positive rational scale factor applied to two-dimensional figures on a coordinate plane with the origin as the center of dilation. **8.6** The student applies mathematical process standards to develop mathematical relationships and make connections to geometric formulas. The student is expected to: (A) **_describe_** the volume formula $V = Bh$ of a cylinder in terms of its base area and its height; (B) **_model_** the relationship between the volume of a cylinder and a cone having both congruent bases and heights **_and connect_** that relationship to the formulas; (C) **_use_** models and diagrams to explain the Pythagorean theorem.	The student will demonstrate an understanding of how to represent and analyze data and how to describe and apply personal financial concepts. **8.5** The student applies mathematical process standards to use proportional and non-proportional relationships to develop foundational concepts of functions. The student is expected to: (C) **_contrast_** bivariate sets of data that suggest a linear relationship with bivariate sets of data that do not suggest a linear relationship from a graphical representation; (D) **_use_** a trend line that approximates the linear relationship between bivariate sets of data to make predictions; **8.11** The student applies mathematical process standards to use statistical procedures to describe data. The student is expected to: (A) **_construct_** a scatterplot and **_describe_** the observed data to address questions of association such as linear, non-linear, and no association between bivariate data; (B) **_determine_** the mean absolute deviation and **_use_** this quantity as a measure of the average distance data are from the mean using a data set of no more than 10 data points; and (C) **_simulate_** generating random samples of the same size from a population with known characteristics to

reasonableness of the solution;

(C) **_select_** tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to **_solve_** problems;

(D) **_communicate_** mathematical ideas, reasoning, and their implications **_using_** multiple representations, including symbols, diagrams, graphs, and language as appropriate;

(E) **_create and use_** representations to organize, record, and communicate mathematical ideas;

(F) **_analyze_** mathematical relationships to connect and communicate mathematical ideas; and

(G) **_display, explain, and justify_** mathematical ideas and arguments **_using_** precise mathematical language in written or oral communication.

(F) **_distinguish_** between proportional and non-proportional situations using tables, graphs, and equations in the form $y = kx$ or $y = mx + b$, where $b \neq 0$;

(G) **_identify_** functions using sets of ordered pairs, tables, mappings, and graphs;

(H) **_identify_** examples of proportional and non-proportional functions that arise from mathematical and real-world problems; and

(I) **_write_** an equation in the form $y = mx + b$ to model a linear relationship between two quantities using verbal, numerical, tabular, and graphical representations.

8.8 The student applies mathematical process standards to use one-variable equations or inequalities in problem situations. The student is expected to:

(A) **_write_** one-variable equations or inequalities with variables on both sides that represent problems using rational number coefficients and constants;

(B) **_write_** a corresponding real-world problem when given a one-variable equation or inequality with variables on both sides of the equal sign using rational number coefficients and constants;

(C) **_model and solve_** one-variable equations with variables on both sides of the equal sign that represent mathematical and real-world problems using rational number coefficients and constants;

8.9 The student applies mathematical process standards to use multiple representations to develop foundational concepts of simultaneous linear equations. The student is expected to:

8.7 The student applies mathematical process standards to use geometry to solve problems. The student is expected to:

(A) **_solve_** problems involving the volume of cylinders, cones, and spheres;

(B) **_use_** previous knowledge of surface area to make connections to the formulas for lateral and total surface area and determine solutions for problems involving rectangular prisms, triangular prisms, and cylinders;

(C) **_use_** the Pythagorean Theorem and its converse to solve problems; and

(D) **_determine_** the distance between two points on a coordinate plane using the Pythagorean Theorem.

8.8 The student applies mathematical process standards to use one-variable equations or inequalities in problem situations. The student is expected to:

(D) **_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.

8.10 The student applies mathematical process standards to develop transformational geometry concepts. The student is expected to:

(A) **_generalize_** the properties of orientation and congruence of rotations, reflections, translations, and dilations of two-dimensional shapes on a coordinate plane;

(B) **_differentiate_** between transformations that preserve congruence and those that do not;

(C) **_explain_** the effect of translations, reflections over the *x*- or *y*-axis, and rotations limited to

develop the notion of a random sample being representative of the population from which it was selected.

8.12 The student applies mathematical process standards to develop an economic way of thinking and problem solving useful in one's life as a knowledgeable consumer and investor. The student is expected to:

(A) **_solve_** real-world problems comparing how interest rate and loan length affect the cost of credit;

(B) **_calculate_** the total cost of repaying a loan, including credit cards and easy access loans, under various rates of interest and over different periods using an online calculator;

(C) **_explain_** how small amounts of money invested regularly, including money saved for college and retirement, grow over time;

(D) **_calculate and compare_** simple interest and compound interest earnings;

(E) **_identify and explain_** the advantages and disadvantages of different payment methods ;

(F) **_analyze_** situations to determine if they represent a financially responsible decision and identify the benefits of financial responsibility and the costs of financial irresponsibility.; and

(G) **_estimate_** the cost of a 2-year and 4-year college education including family contribution and devise a periodic savings plan for accumulating the money needed to contribute to the total cost of attendance for at least the 1st year of college.

	(A) _**identify and verify**_ the values of *x* and *y* that simultaneously satisfy two linear equations in the form *y* = *mx* + *b* from the intersections of the graphed equations.	90°, 180°, 270°, and 360° as applied to two-dimensional shapes on a coordinate plane using an algebraic representation; and (D) _**model**_ the effect on linear and area measurements of dilated two-dimensional shapes.	
Mathematical Process Standards	**Reporting Category 1:** **Numerical Representations & Relationships**	**Reporting Category 2:** **Computations and Algebraic Relationships**	**Reporting Category 3:** **Geometry and Measurement**	**Reporting Category 4:** **Data Analysis and Personal Financial Literacy**
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