Math, Grade 8 (IMRA)

Subject: Mathematics
Grade: 08
Expectations: 52
Breakouts: 152

(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, 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.
4. Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(b) Knowledge and Skills Statements

(1) Mathematical process standards. 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;

- (i) apply mathematics to problems arising in everyday life
- (ii) apply mathematics to problems arising in society
- (iii) apply mathematics to problems arising in 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 evaluating the problem-solving process and the reasonableness of the solution;

- (i) 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
- (ii) use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the 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;

- (i) select tools, including real objects as appropriate, to solve problems
- (ii) select tools, including manipulatives as appropriate, to solve problems
- (iii) select tools, including paper and pencil as appropriate, to solve problems
- (iv) select tools, including technology as appropriate, to solve problems
- (v) select techniques, including mental math as appropriate, to solve problems
- (vi) select techniques, including estimation as appropriate, to solve problems
- (vii) select techniques, including 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;

- (i) communicate mathematical ideas using multiple representations, including symbols as appropriate
- (ii) communicate mathematical ideas using multiple representations, including diagrams as appropriate
- (iii) communicate mathematical ideas using multiple representations, including graphs as appropriate
- (iv) communicate mathematical ideas using multiple representations, including language as appropriate
- (v) communicate mathematical reasoning using multiple representations, including symbols as appropriate
- (vi) communicate mathematical reasoning using multiple representations, including diagrams as appropriate
- (vii) communicate mathematical reasoning using multiple representations, including graphs as appropriate
- (viii) communicate mathematical reasoning using multiple representations, including language as appropriate
- (ix) communicate [mathematical ideas'] implications using multiple representations, including symbols as appropriate
- (x) communicate [mathematical ideas'] implications using multiple representations, including diagrams as appropriate
- (xi) communicate [mathematical ideas'] implications using multiple representations, including graphs as appropriate
- (xii) communicate [mathematical ideas'] implications using multiple representations, including language as appropriate

(xiii) communicate [mathematical reasoning's] implications using multiple representations, including symbols as appropriate

(xiv) communicate [mathematical reasoning's] implications using multiple representations, including diagrams as appropriate

(xv) communicate [mathematical reasoning's] implications using multiple representations, including graphs as appropriate

(xvi) communicate [mathematical reasoning's] implications using multiple representations, including language as appropriate

(E) create and use representations to organize, record, and communicate mathematical ideas;

(i) create representations to organize mathematical ideas

(ii) use representations to organize mathematical ideas

(iii) create representations to record mathematical ideas

(iv) use representations to record mathematical ideas

(v) create representations to communicate mathematical ideas

(vi) use representations to communicate mathematical ideas

(F) analyze mathematical relationships to connect and communicate mathematical ideas; and

(i) analyze mathematical relationships to connect mathematical ideas

(ii) analyze mathematical relationships to communicate mathematical ideas

(G) display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

(i) display mathematical ideas using precise mathematical language in written or oral communication

(ii) display mathematical arguments using precise mathematical language in written or oral communication

(iii) explain mathematical ideas using precise mathematical language in written or oral communication

(iv) explain mathematical arguments using precise mathematical language in written or oral communication

(v) justify mathematical ideas using precise mathematical language in written or oral communication

(vi) justify mathematical arguments using precise mathematical language in written or oral communication

(2) Number and operations. 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;

(i) 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;

(i) approximate the value of an irrational number, including π

(ii) approximate the value of an irrational number, including square roots of numbers less than 225

(iii) locate that rational number approximation on a number line

(C) convert between standard decimal notation and scientific notation; and

(i) convert between standard decimal notation and scientific notation

(D) order a set of real numbers arising from mathematical and real-world contexts.

(i) order a set of real numbers arising from mathematical contexts

(ii) order a set of real numbers arising from real-world contexts

(3) Proportionality. 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;

(i) 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

(i) compare and contrast the attributes of a shape and its dilation(s) on a coordinate plane

(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.

(i) 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

(4) Proportionality. 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, (y2 - y1)/ (x2 - x1), is the same for any two points (x1, y1) and (x2, y2) on the same line

(i) 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, (y2 - y1)/ (x2 - x1), is the same for any two points (x1, y1) and (x2, y2) on the same line

(B) graph proportional relationships, interpreting the unit rate as the slope of the line that models the relationship; and

(i) graph proportional relationships, interpreting the unit rate as the slope of the line that models the relationship

(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.

(i) use data from a table or graph to determine the rate of change or slope in mathematical problems

(ii) use data from a table or graph to determine the rate of change or slope in real-world problems

(iii) use data from a table or graph to determine the y-intercept in mathematical problems

(iv) use data from a table or graph to determine the y-intercept in real-world problems

(5) Proportionality. 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 $y= kx$

- (i) represent linear proportional situations with tables
- (ii) represent linear proportional situations with graphs
- (iii) represent linear proportional situations with 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 $b \neq 0$

- (i) represent linear non-proportional situations with tables
- (ii) represent linear non-proportional situations with graphs
- (iii) represent linear non-proportional situations with equations in the form of $y = mx + b$, where $b \neq 0$

(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;

- (i) 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;

- (i) use a trend line that approximates the linear relationship between bivariate sets of data to make predictions

(E) solve problems involving direct variation;

- (i) solve problems involving direct variation

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

- (i) distinguish between proportional and non-proportional situations using tables
- (ii) distinguish between proportional and non-proportional situations using graphs
- (iii) distinguish between proportional and non-proportional situations using 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;

- (i) identify functions using sets of ordered pairs
- (ii) identify functions using tables
- (iii) identify functions using mappings
- (iv) identify functions using graphs

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

- (i) identify examples of proportional functions that arise from mathematical problems
- (ii) identify examples of proportional functions that arise from real-world problems
- (iii) identify examples of non-proportional functions that arise from mathematical problems
- (iv) identify examples of non-proportional functions that arise from real-world problems

(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

(i) write an equation in the form y = mx + b to model a linear relationship between two quantities using verbal representations

(ii) write an equation in the form y = mx + b to model a linear relationship between two quantities using numerical representations

(iii) write an equation in the form y = mx + b to model a linear relationship between two quantities using tabular representations

(iv) write an equation in the form y = mx + b to model a linear relationship between two quantities using graphical representations

(6) Expressions, equations, and relationships. 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

(i) 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; and

(i) model the relationship between the volume of a cylinder and a cone having both congruent bases and heights

(ii) connect that relationship to the formulas

(C) use models and diagrams to explain the Pythagorean theorem.

(i) use models to explain the Pythagorean theorem

(ii) use diagrams to explain the Pythagorean theorem

(7) Expressions, equations, and relationships. 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;

(i) solve problems involving the volume of cylinders

(ii) solve problems involving the volume of cones

(iii) solve problems involving the volume of 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;

(i) use previous knowledge of surface area to make connections to the formulas for lateral surface area

(ii) use previous knowledge of surface area to make connections to the formulas for total surface area

(iii) determine solutions for problems involving rectangular prisms

(iv) determine solutions for problems involving triangular prisms

(v) determine solutions for problems involving cylinders

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

(i) use the Pythagorean Theorem to solve problems

(ii) use [the Pythagorean Theorem's] converse to solve problems

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

(i) determine the distance between two points on a coordinate plane using the Pythagorean Theorem

(8) Expressions, equations, and relationships. 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;

(i) 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;

(i) 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; and

(i) model one-variable equations with variables on both sides of the equal sign that represent mathematical problems using rational number coefficients and constants

(ii) model one-variable equations with variables on both sides of the equal sign that represent real-world problems using rational number coefficients and constants

(iii) solve one-variable equations with variables on both sides of the equal sign that represent mathematical problems using rational number coefficients and constants

(iv) solve one-variable equations with variables on both sides of the equal sign that represent real-world problems using rational number coefficients and constants

(D) use informal arguments to establish facts about the angle sum and exterior angle of triangles, the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles.

(i) use informal arguments to establish facts about the angle sum of triangles

(ii) use informal arguments to establish facts about the exterior angles of triangles

(iii) use informal arguments to establish facts about the angles created when parallel lines are cut by a transversal

(iv) use informal arguments to establish facts about the angle-angle criterion for similarity of triangles

(9) Expressions, equations, and relationships. The student applies mathematical process standards to use multiple representations to develop foundational concepts of simultaneous linear equations. The student is expected to:

(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

(i) identify 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

(ii) 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

(10) Two-dimensional shapes. 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;

(i) generalize the properties of orientation rotations of two-dimensional shapes on a coordinate plane

(ii) generalize the properties of orientation reflections of two-dimensional shapes on a coordinate plane

(iii) generalize the properties of orientation translations of two-dimensional shapes on a coordinate plane

(iv) generalize the properties of orientation dilations of two-dimensional shapes on a coordinate plane

(v) generalize the properties of congruence of rotations of two-dimensional shapes on a coordinate plane

(vi) generalize the properties of congruence of reflections of two-dimensional shapes on a coordinate plane

(vii) generalize the properties of congruence of translations of two-dimensional shapes on a coordinate plane

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

(i) 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 90°, 180°, 270°, and 360° as applied to two-dimensional shapes on a coordinate plane using an algebraic representation; and

(i) explain the effect of translations as applied to two-dimensional shapes on a coordinate plane using an algebraic representation

(ii) explain the effect of reflections over the x- or y-axis as applied to two-dimensional shapes on a coordinate plane using an algebraic representation

(iii) explain the effect of rotations [of] 90° as applied to two-dimensional shapes on a coordinate plane using an algebraic representation

(iv) explain the effect of rotations [of] 180° as applied to two-dimensional shapes on a coordinate plane using an algebraic representation

(v) explain the effect of rotations [of] 270° as applied to two-dimensional shapes on a coordinate plane using an algebraic representation

(vi) explain the effect of rotations [of] 360° as applied to two-dimensional shapes on a coordinate plane using an algebraic representation

(D) model the effect on linear and area measurements of dilated two-dimensional shapes.

(i) model the effect on linear measurements of dilated two-dimensional shapes

(ii) model the effect on area measurements of dilated two-dimensional shapes

(11) Measurement and data. 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;

(i) construct a scatterplot

(ii) describe the observed data to address questions of association

(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

(i) determine the mean absolute deviation

(ii) 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

(C) simulate generating random samples of the same size from a population with known characteristics to develop the notion of a random sample being representative of the population from which it was selected.

(i) simulate generating random samples of the same size from a population with known characteristics to develop the notion of a random sample being representative of the population from which it was selected

(12) Personal financial literacy. 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;

(i) solve real-world problems comparing how interest rate affect[s] the cost of credit

(ii) solve real-world problems comparing how loan length affect[s] 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;

(i) calculate the total cost of repaying a loan, including credit cards, under various rates of interest using an online calculator

(ii) calculate the total cost of repaying a loan, including credit cards, over different periods using an online calculator

(iii) calculate the total cost of repaying a loan, including easy access loans, under various rates of interest using an online calculator

(iv) calculate the total cost of repaying a loan, including easy access loans, 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;

(i) explain how small amounts of money invested regularly, including money saved for college, grow over time

(ii) explain how small amounts of money invested regularly, including money saved for retirement, grow over time

(D) calculate and compare simple interest and compound interest earnings;

(i) calculate simple interest earnings

(ii) calculate compound interest earnings

(iii) compare simple interest and compound interest earnings

(E) identify and explain the advantages and disadvantages of different payment methods;

(i) identify the advantages of different payment methods

(ii) identify the disadvantages of different payment methods

(iii) explain the advantages of different payment methods

(iv) explain the disadvantages of different payment methods

(F) analyze situations to determine if they represent financially responsible decisions and identify the benefits of financial responsibility and the costs of financial irresponsibility; and

(i) analyze situations to determine if they represent financially responsible decisions

(ii) identify the benefits of financial responsibility

(iii) identify the costs of financial irresponsibility

(G) estimate the cost of a two-year and four-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 first year of college.

(i) estimate the cost of a two-year college education, including family contribution

(ii) estimate the cost of a four-year college education, including family contribution

(iii) devise a periodic savings plan for accumulating the money needed to contribute to the total cost of attendance for at least the first year of college