Vermont Comprehensive Assessment Program (VTCAP)

VERMONT AGENCY OF EDUCATION

Practice Test Alignment Document

Mathematics | Grade 8

Sequence Number	Standard	Learning Target
Session 1		
1	08.EE.02.06 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*.	Identify statements that describe similar triangles graphed on a coordinate plane.
2	08.NS.01.02 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.*	Determine between which two integers a square root falls.
3	08.F.02.05 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.	Identify a graph that represents a real-world situation.
4	08.F.02.04 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.	Use a table of data to find a solution within the context it describes.
5	08.G.01.03 Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.	Identify the ordered pair that describes the location of a vertex after a series of transformations.

Sequence Number	Standard	Learning Target
6	08.SP.01.01 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.	Create a scatter plot from a table of data.
7	08.SP.01.02 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.	Analyze data represented on a scatter plot.
8	08.EE.01.04 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 (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.	Use scientific notation to perform an operation.
9*	08.SP.01.03 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.*	Use the equation of a linear model that represents a scatter plot to interpret the slope and solve a problem within the context it describes.
10	08.G.03.09 Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.	Find the volume of a cone in cubic centimeters.
11	08.SP.01.02 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.	Identify a reasonable prediction based on a scatter plot.

Sequence Number	Standard	Learning Target
12	08.F.01.02 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 greatest rate of change.*	Compare the parameters of two functions represented by a table and an equation.
13	08.EE.01.01 Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, $3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27$.	Identify an equation that correctly uses the rules of exponents.
14	08.NS.01.01 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.	Identify the equivalent fraction of a repeated decimal.
15	08.SP.01.04 Explain 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. *For example, collect data from 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?*	Calculate a percentage from a two-way table within the context it describes.
16*	08.F.02.04 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.	Create and interpret a linear equation based on a real-life situation.

Sequence Number	Standard	Learning Target
17	08.NS.01.02 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.*	Compare irrational numbers.
18	08.EE.03.08 Analyze and solve pairs of simultaneous linear equations.	Determine the information needed to solve a problem.
19	08.EE.01.04 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 (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.	Identify the step needed to find the sum of two expressions written in scientific notation.
20	08.G.02.07 Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.	Describe the steps to prove the Pythagorean Theorem based on a given model.
21	08.G.03.09 Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.	Identify the dimensions of a cylinder given the volume.
Session 2		
1	08.F.01.01 Define a function as a rule that assigns to each input exactly one output. Show that the graph of a function is the set of ordered pairs consisting of an input and the corresponding output. (Function notation is not required for Grade 8.)	Describe how to determine whether a table of values represents a function.

Sequence Number	Standard	Learning Target
2	08.SP.01.03 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.*	Use the equation of a line of best fit to solve a problem within a context.
3	08.G.01.02 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.	Identify a transformation of two congruent triangles given coordinates and a graph.
4	08.G.01.03 Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.	Compare the side lengths of two similar triangles.
5	08.EE.02.05 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.*	Graph a line based on the verbal description of a linear relationship.
6	08.F.02.05 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.	Identify the increasing intervals of the graph of a nonlinear function.
7	08.SP.01.01 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.	Identify an ordered pair that represents the outlier of a given scatter plot.

Sequence Number	Standard	Learning Target
8	08.G.01.03 Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.	Identify an ordered pair of a triangle after a dilation.
9*	08.G.02.07 Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.	Use the Pythagorean Theorem to solve a mathematical problem involving a three-dimensional shape.
10	08.EE.03.07 Solve linear equations in one variable.	Solve an equation with variables on both sides.
11	08.EE.03.07 Solve linear equations in one variable.	Determine whether an equation has no solution, exactly one solution, or infinitely many solutions.
12	08.SP.01.04 Explain 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. *For example, collect data from 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?*	Analyze data represented in a two-way frequency table.
13	08.NS.01.01 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.	Determine the validity of statements describing a decimal number that repeats.
14	08.SP.01.02 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.	Identify the equation that describes the line of best fit of a given scatter plot.

Sequence Number	Standard	Learning Target
15*	08.EE.03.08.c Solve real-world and mathematical problems leading to two linear equations in two variables. *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.*	Write a system of equations and use it to solve a problem within the context it describes.
16	08.EE.03.07.b Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.	Identify a step in solving an equation involving the distributive property.
17	08.F.02.04 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.	Create an equation given an input-output table.
18	08.F.01.01 Define a function as a rule that assigns to each input exactly one output. Show that the graph of a function is the set of ordered pairs consisting of an input and the corresponding output. (Function notation is not required for Grade 8.)	Identify a table that represents a function.
19	08.G.02.07 Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.	Use the Pythagorean Theorem to solve a real-world problem.
20	08.F.01.03 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.*	Determine whether a table represents a linear function.

*This is a hand-scored question. The scoring rubric can be found at the end of this document for reference.

Scoring Rubrics

Session 1

Question 9

Concepts and Procedures Scoring Rubric

Score	Description
2	The student earns 2 points.
1	The student earns 1 point.
0	The student earns 0 points.
Blank	No response.

Concepts and Procedures Training Notes:

Part a

1 point for correct answer, **1 bottle of water is sold for every 1 soft pretzel sold**, or equivalent

Part b

1 point for correct answer, **23**

Mathematical Practices Scoring Rubric

Score	Description
1	The student earns 1 point.
0	The student earns 0 points.
Blank	No response.

Mathematical Practices Training Notes:

1 point for interpreting and analyzing models (interpret the data either from the graph or from the equation to extrapolate the predicted value)

Exemplary Response:

a. 1 bottle of water is sold for every 1 soft pretzel sold

b. 23; $y = x + 0.5 = 1(22) + 0.5 = 22.5$ or about 23

Scoring Rubrics

Session 1

Question 16

Concepts and Procedures Scoring Rubric

Score	Description
4	The student earns 5 points.
3	The student earns 4 points.
2	The student earns 2 or 3 points.
1	The student earns 1 point.
0	The student earns 0 points.
Blank	No response.

Concepts and Procedures Training Notes:

Part a

1 point for a viable equation, $\boldsymbol{y = 0.50x + 4.50}$ or equivalent

Part b

2 points for viable answer, **the slope represents the cost of each additional bead and the *y*-intercept represents the cost of the bracelet without any beads**, or a correct answer based on an incorrect answer in part (a) that shows understanding of interpreting the rate of change and initial value of a linear function in terms of the situation it models

OR

1 point for a viable answer for either the slope or the *y*-intercept

Part c

2 points for correct answer, ($)**10.50** or a correct answer based on an incorrect answer in part (a), with sufficient work or explanation that shows understanding of using functions to model relationships between quantities

OR

1 point for correct answer or a correct answer based on an incorrect answer in part (a) with insufficient or no work or explanation; or for appropriate strategy that shows understanding of using functions to model relationships between quantities with incorrect or no answer

Scoring Rubrics

Mathematical Practices Scoring Rubric

Score	Description
2	The student earns 2 points.
1	The student earns 1 point.
0	The student earns 0 points.
Blank	No response.

Mathematical Practices Training Notes:

1 point for creating and interpreting a model (creates a viable equation and interprets the slope and *y*-intercept of the equation)

1 point for using a model to solve a problem (uses the equation for the function to determine the cost of a bracelet with 12 beads)

Exemplary Response:

a. $y = 5.00 + 0.5(x-1) = y = 0.50x + 4.50$

b. The slope is 0.50, which means the cost of the bracelet increases by 50¢ for each additional bead. The *y*-intercept is 4.50, which means the cost of a bracelet without any beads is $4.50.

c. $10.50;

$y = 0.50(12) + 4.50$

$y = 6 + 4.50$

$y = 10.50$

Scoring Rubrics

Session 2

Question 9

Concepts and Procedures Scoring Rubric

Score	Description
2	The student earns 2 points.
1	The student earns 1 point.
0	The student earns 0 points.
Blank	No response.

Concepts and Procedures Training Notes:

Part a

1 point for viable work or explanation on how to find the length of $\overline{PQ}$

Part b

1 point for correct answer, **18.41 (centimeters)**, or equivalent

Note: also accept correct answer, 18 (centimeters) for estimated length

Mathematical Practices Scoring Rubric

Score	Description
1	The student earns 1 point.
0	The student earns 0 points.
Blank	No response.

Mathematical Practices Training Notes:

1 point for relying on using models to help conceptualize and solve a problem (using the Pythagorean Theorem to calculate the diagonals of the prism in part b)

Scoring Rubrics

Exemplary Response:

a. $\sqrt{17^2 + 5^2}$

b. 18.41 (centimeters); first find the length of $\overline{PQ}$,

$$\sqrt{17^2 + 5^2} = \sqrt{289 + 25}$$
$$= \sqrt{314}$$
$$\approx 17.72$$

Using the Pythagorean Theorem, $\sqrt{(PQ)^2 + (QR)^2} = PR$, and substituting the values for $PQ = 17.72$, and $QR = 5$,

$$PR = \sqrt{17.72^2 + 5^2}$$
$$= \sqrt{338.9984}$$
$$\approx 18.41$$

Scoring Rubrics

Session 2

Question 15

Concepts and Procedures Scoring Rubric

Score	Description
4	The student earns 4 points.
3	The student earns 3 points.
2	The student earns 2 points.
1	The student earns 1 point.
0	The student earns 0 points.
Blank	No response.

Concepts and Procedures Training Notes:

Part a

1 point for correct answers, **$3x + 2y = 180$; $x + 2y = 100$**, or equivalent

Part b

2 points for two correct answers, **$40 adult and $30 child**

OR

1 point for one correct answer, **$40 adult or $30 child**

Part c

1 point for correct answer, **$35**

Mathematical Practices Scoring Rubric

Score	Description
2	The student earns 2 points.
1	The student earns 1 point.
0	The student earns 0 points.
Blank	No response.

Scoring Rubrics

Mathematical Practices Training Notes:

1 point for knowing and flexibly using different properties of operations (uses a process to solve the system of equations for both unknown prices in part [b])

1 point for making sense of quantities and their relationships in problem situations (uses an expression or equation for the total price of tickets for the Gupta family and substitutes the values for the adult and child prices into it to determine the price of the senior citizen ticket in part [c])

Exemplary Response:

a. $3x + 2y = 180$; $x + 2y = 100$

b. $40 (adult ticket); $30 (child ticket)

Using the elimination method:

$$3x + 2y = 180$$

$$\underline{-(x + 2y = 100)}$$

$$2x = 80$$

$$\frac{2x}{2} = \frac{80}{2}$$

$$x = 40$$

Substituting back into the equation $x + 2y = 100$ and solving for y,

$$40 + 2y = 100$$

$$2y = 100 - 40$$

$$\frac{2y}{2} = \frac{60}{2}$$

$$y = 30$$

c. $35 (senior citizen); using the Gupta family equation $2x + 4y + s = 235$ and substituting x for 40 and y for 30,

$$2(40) + 4(30) + s = 235$$

$$80 + 120 + s = 235$$

$$200 + s = 235$$

$$s = 35$$