Virginia Mathematics

Grade 8

Number and Number Sense

NS.1 **The student will compare and order real numbers and determine the relationships between real numbers.** 8.NS.1

NS.2 **The student will investigate and describe the relationship between the subsets of the real number system.** 8.NS.2

Students will demonstrate the following Knowledge and Skills:

a Describe and illustrate the relationships among the subsets of the real number system by using representations (e.g., graphic organizers, number lines). Subsets include rational numbers, irrational numbers, integers, whole numbers, and natural numbers. 8.NS.2.A

b Classify and explain why a given number is a member of a particular subset or subsets of the real number system. 8.NS.2.B

c Describe each subset of the set of real numbers and include examples and non-examples. 8.NS.2.C

Estimate and identify the two consecutive natural numbers between which the positive square root of a given number lies and justify which natural number is the better approximation. Numbers are limited to natural numbers from 1 to 400. 8.NS.1.A

a **Estimate and identify the two consecutive natural numbers between which the positive square root of a given number lies and justify which natural number is the better approximation. Numbers are limited to natural numbers from 1 to 400.** 8.NS.1.A

Use rational approximations (to the nearest hundredth) of irrational numbers to compare, order, and locate values on a number line. Radicals may include both positive and negative square roots of values from 0 to 400 yielding an

b **Use rational approximations (to the nearest hundredth) of irrational numbers to compare, order, and locate values on a number line. Radicals may include both positive and negative square roots of values from 0 to 400 yielding an irrational number.** 8.NS.1.B

irrational number. 8.NS.1.B	
Use multiple strategies (e.g., benchmarks, number line, equivalency) to compare and order no more than five real numbers expressed as integers, fractions (proper or improper), decimals, mixed numbers, percents, numbers written in scientific notation, radicals, and π. Radicals may include both positive and negative square roots of values from 0 to 400. Ordering may be in ascending or descending order. Justify solutions orally, in writing or with a model. 8.NS.1.C	c Use multiple strategies (e.g., benchmarks, number line, equivalency) to compare and order no more than five real numbers expressed as integers, fractions (proper or improper), decimals, mixed numbers, percents, numbers written in scientific notation, radicals, and π. Radicals may include both positive and negative square roots of values from 0 to 400. Ordering may be in ascending or descending order. Justify solutions orally, in writing or with a model. 8.NS.1.C
Computation and Estimation	CE.1 The student will estimate and apply proportional reasoning and computational procedures to solve contextual problems. 8.CE.1
Estimate and solve contextual problems that require the computation of one discount or markup and the resulting sale price. 8.CE.1.A	a Estimate and solve contextual problems that require the computation of one discount or markup and the resulting sale price. 8.CE.1.A
Estimate and solve contextual problems that require the computation of the sales tax, tip and resulting total. 8.CE.1.B	b Estimate and solve contextual problems that require the computation of the sales tax, tip and resulting total. 8.CE.1.B
Estimate and solve contextual problems that require the computation of the	c Estimate and solve contextual problems that require the computation of the percent increase or decrease. 8.CE.1.C

percent increase or decrease. 8.CE.1.C	
Measurement and Geometry	**MG.1** The student will use the relationships among pairs of angles that are vertical angles, adjacent angles, supplementary angles, and complementary angles to determine the measure of unknown angles.
	MG.2 The student will investigate and determine the surface area of square-based pyramids and the volume of cones and square-based pyramids. 8.MG.2
	MG.3 The student will apply translations and reflections to polygons in the coordinate plane. 8.MG.3
	MG.4 The student will apply the Pythagorean Theorem to solve problems involving right triangles, including those in context. 8.MG.4
	MG.5 The student will solve area and perimeter problems involving composite plane figures, including those in context. 8.MG.5
Identify and describe the relationship between pairs of angles that are vertical, adjacent, supplementary, and complementary. 8.MG.1.A	**a** Identify and describe the relationship between pairs of angles that are vertical, adjacent, supplementary, and complementary. 8.MG.1.A
Use the relationships among supplementary, complementary, vertical, and adjacent angles to solve problems, including those in context, involving the measure of unknown angles. 8.MG.1.B	**b** Use the relationships among supplementary, complementary, vertical, and adjacent angles to solve problems, including those in context, involving the measure of unknown angles. 8.MG.1.B
Determine the surface area of square-based pyramids by using concrete objects, nets, diagrams, and formulas. 8.MG.2.A	**a** Determine the surface area of square-based pyramids by using concrete objects, nets, diagrams, and formulas. 8.MG.2.A
Determine the volume of cones and square-based pyramids, using concrete objects,	**b** Determine the volume of cones and square-based pyramids, using concrete objects, diagrams, and formulas. 8.MG.2.B

diagrams, and formulas. 8.MG.2.B	
Examine and explain the relationship between the volume of cones and cylinders, and the volume of rectangular prisms and square based pyramids. 8.MG.2.C	c Examine and explain the relationship between the volume of cones and cylinders, and the volume of rectangular prisms and square based pyramids. 8.MG.2.C
Solve problems in context involving volume of cones and square-based pyramids and the surface area of square-based pyramids. 8.MG.2.D	d Solve problems in context involving volume of cones and square-based pyramids and the surface area of square-based pyramids. 8.MG.2.D
Given a preimage in the coordinate plane, identify the coordinates of the image of a polygon that has been translated vertically, horizontally, or a combination of both. 8.MG.3.A	a Given a preimage in the coordinate plane, identify the coordinates of the image of a polygon that has been translated vertically, horizontally, or a combination of both. 8.MG.3.A
Given a preimage in the coordinate plane, identify the coordinates of the image of a polygon that has been reflected over the x- or y-axis 8.MG.3.B	b Given a preimage in the coordinate plane, identify the coordinates of the image of a polygon that has been reflected over the x- or y-axis 8.MG.3.B
Given a preimage in the coordinate plane, identify the coordinates of the image of a polygon that has been translated and reflected over the x- or y-axis or reflected over the x- or y-axis and then translated. 8.MG.3.C	c Given a preimage in the coordinate plane, identify the coordinates of the image of a polygon that has been translated and reflected over the x- or y-axis or reflected over the x- or y-axis and then translated. 8.MG.3.C

Sketch the image of a polygon that has been translated vertically, horizontally, or a combination of both. 8.MG.3.D	d Sketch the image of a polygon that has been translated vertically, horizontally, or a combination of both. 8.MG.3.D
Sketch the image of a polygon that has been reflected over the x- or y-axis. 8.MG.3.E	e Sketch the image of a polygon that has been reflected over the x- or y-axis. 8.MG.3.E
Sketch the image of a polygon that has been translated and reflected over the x- or y-axis, or reflected over the x- or y-axis and then translated. 8.MG.3.F	f Sketch the image of a polygon that has been translated and reflected over the x- or y-axis, or reflected over the x- or y-axis and then translated. 8.MG.3.F
Identify and describe transformations in context (e.g., tiling, fabric, wallpaper designs, art). 8.MG.3.G	g Identify and describe transformations in context (e.g., tiling, fabric, wallpaper designs, art). 8.MG.3.G
Verify the Pythagorean Theorem using diagrams, concrete materials, and measurement. 8.MG.4.A	a Verify the Pythagorean Theorem using diagrams, concrete materials, and measurement. 8.MG.4.A
Determine whether a triangle is a right triangle given the measures of its three sides. 8.MG.4.B	b Determine whether a triangle is a right triangle given the measures of its three sides. 8.MG.4.B
Identify the parts of a right triangle (the hypotenuse and the legs) given figures in various orientations. 8.MG.4.C	c Identify the parts of a right triangle (the hypotenuse and the legs) given figures in various orientations. 8.MG.4.C
Determine the measure of a side of a right triangle, given the	d Determine the measure of a side of a right triangle, given the measures of the other two sides. 8.MG.4.D

measures of the other two sides. 8.MG.4.D		
Apply the Pythagorean Theorem, and its converse, to solve problems involving right triangles in context. 8.MG.4.E	e	Apply the Pythagorean Theorem, and its converse, to solve problems involving right triangles in context. 8.MG.4.E
Subdivide a plane figure into triangles, rectangles, squares, trapezoids, parallelograms, circles, and semicircles. Determine the area of subdivisions and combine to determine the area of the composite plane figure. 8.MG.5.A	a	Subdivide a plane figure into triangles, rectangles, squares, trapezoids, parallelograms, circles, and semicircles. Determine the area of subdivisions and combine to determine the area of the composite plane figure. 8.MG.5.A
Subdivide a plane figure into triangles, rectangles, squares, trapezoids, parallelograms, and semicircles. Use the attributes of the subdivisions to determine the perimeter of the composite plane figure. 8.MG.5.B	b	Subdivide a plane figure into triangles, rectangles, squares, trapezoids, parallelograms, and semicircles. Use the attributes of the subdivisions to determine the perimeter of the composite plane figure. 8.MG.5.B
Apply perimeter, circumference, and area formulas to solve contextual problems involving composite plane figures. 8.MG.5.C	c	Apply perimeter, circumference, and area formulas to solve contextual problems involving composite plane figures. 8.MG.5.C
Probability and Statistics	PS.1	The student will use statistical investigation to determine the probability of independent and dependent events, including those in context. 8.PS.1
	PS.2	The student will apply the data cycle (formulate questions; collect or acquire data; organize and represent data; and analyze data and communicate results) with a focus on boxplots. 8.PS.2

	PS.3 The student will apply the data cycle (formulate questions; collect or acquire data; organize and represent data; and analyze data and communicate results) with a focus on scatterplots. 8.PS.3
Determine whether two events are independent or dependent and explain how replacement impacts the probability. 8.PS.1.A	**a** Determine whether two events are independent or dependent and explain how replacement impacts the probability. 8.PS.1.A
Compare and contrast the probability of independent and dependent events. 8.PS.1.B	**b** Compare and contrast the probability of independent and dependent events. 8.PS.1.B
Determine the probability of two independent events. 8.PS.1.C	**c** Determine the probability of two independent events. 8.PS.1.C
Determine the probability of two dependent events. 8.PS.1.D	**d** Determine the probability of two dependent events. 8.PS.1.D
Formulate questions that require the collection or acquisition of data with a focus on boxplots. 8.PS.2.A	**a** Formulate questions that require the collection or acquisition of data with a focus on boxplots. 8.PS.2.A
Determine the data needed to answer a formulated question and collect the data (or acquire existing data) using various methods (e.g., observations, measurement, surveys, experiments). 8.PS.2.B	**b** Determine the data needed to answer a formulated question and collect the data (or acquire existing data) using various methods (e.g., observations, measurement, surveys, experiments). 8.PS.2.B
Determine how statistical bias might affect whether the data	**c** Determine how statistical bias might affect whether the data collected from the sample is representative of the larger population. 8.PS.2.C

collected from the sample is representative of the larger population. 8.PS.2.C	
Organize and represent a numeric data set of no more than 20 items, using boxplots, with and without the use of technology. 8.PS.2.D	**d** Organize and represent a numeric data set of no more than 20 items, using boxplots, with and without the use of technology. 8.PS.2.D
Identify and describe the lower extreme (minimum), upper extreme (maximum), median, upper quartile, lower quartile, range, and interquartile range given a data set, represented by a boxplot. 8.PS.2.E	**e** Identify and describe the lower extreme (minimum), upper extreme (maximum), median, upper quartile, lower quartile, range, and interquartile range given a data set, represented by a boxplot. 8.PS.2.E
Describe how the presence of an extreme data point (outlier) affects the shape and spread of the data distribution of a boxplot. 8.PS.2.F	**f** Describe how the presence of an extreme data point (outlier) affects the shape and spread of the data distribution of a boxplot. 8.PS.2.F
Analyze data represented in a boxplot by making observations and drawing conclusions. 8.PS.2.G	**g** Analyze data represented in a boxplot by making observations and drawing conclusions. 8.PS.2.G
Compare and analyze two data sets represented in boxplots. 8.PS.2.H	**h** Compare and analyze two data sets represented in boxplots. 8.PS.2.H
Given a contextual situation, justify which graphical representation (e.g., pictographs, bar graphs, line graphs, line plots/dot plots, stem-and-leaf plots, circle	**i** Given a contextual situation, justify which graphical representation (e.g., pictographs, bar graphs, line graphs, line plots/dot plots, stem-and-leaf plots, circle graphs, histograms, and boxplots) best represents the data. 8.PS.2.I

graphs, histograms, and boxplots) best represents the data. 8.PS.2.I	
Identify components of graphical displays that can be misleading. 8.PS.2.J	j Identify components of graphical displays that can be misleading. 8.PS.2.J
Formulate questions that require the collection or acquisition of data with a focus on scatterplots. 8.PS.3.A	a Formulate questions that require the collection or acquisition of data with a focus on scatterplots. 8.PS.3.A
Determine the data needed to answer a formulated question and collect the data (or acquire existing data) of no more than 20 items using various methods (e.g., observations, measurement, surveys, experiments). 8.PS.3.B	b Determine the data needed to answer a formulated question and collect the data (or acquire existing data) of no more than 20 items using various methods (e.g., observations, measurement, surveys, experiments). 8.PS.3.B
Organize and represent numeric bivariate data using scatterplots with and without the use of technology. 8.PS.3.C	c Organize and represent numeric bivariate data using scatterplots with and without the use of technology. 8.PS.3.C
Make observations about a set of data points in a scatterplot as having a positive linear relationship, a negative linear relationship, or no relationship 8.PS.3.D	d Make observations about a set of data points in a scatterplot as having a positive linear relationship, a negative linear relationship, or no relationship 8.PS.3.D
Analyze and justify the relationship of the quantitative bivariate data represented in scatterplots. 8.PS.3.E	e Analyze and justify the relationship of the quantitative bivariate data represented in scatterplots. 8.PS.3.E

Sketch the line of best fit for data represented in a scatterplot. 8.PS.3.F	**f**	**Sketch the line of best fit for data represented in a scatterplot.** 8.PS.3.F
Patterns, Functions, and Algebra	**PFA.1**	**The student will represent, simplify, and generate equivalent algebraic expressions in one variable.** 8.PFA.1
	PFA.2	**The student will determine whether a given relation is a function and determine the domain and range of a function.** 8.PFA.2
	PFA.3	**The student will represent and solve problems, including those in context, by using linear functions and analyzing their key characteristics (the value of the y-intercept (b) and the coordinates of the ordered pairs in graphs will be limited to integers).** 8.PFA.3
	PFA.4	**The student will write and solve multistep linear equations in one variable, including problems in context that require the solution of a multistep linear equation in one variable.** 8.PFA.4
	PFA.5	**The student will write and solve multistep linear inequalities in one variable, including problems in context that require the solution of a multistep linear inequality in one variable.** 8.PFA.5
Represent algebraic expressions using concrete manipulatives or pictorial representations (e.g., colored chips, algebra tiles), including expressions that apply the distributive property. 8.PFA.1.A	**a**	**Represent algebraic expressions using concrete manipulatives or pictorial representations (e.g., colored chips, algebra tiles), including expressions that apply the distributive property.** 8.PFA.1.A
Simplify and generate equivalent algebraic expressions in one variable by applying the order of operations and properties of real numbers. Expressions may need to be expanded (using the distributive property) or require combining like terms to simplify. Expressions will include only linear and numeric terms. Coefficients and	**b**	**Simplify and generate equivalent algebraic expressions in one variable by applying the order of operations and properties of real numbers. Expressions may need to be expanded (using the distributive property) or require combining like terms to simplify. Expressions will include only linear and numeric terms. Coefficients and numeric terms may be rational.** 8.PFA.1.B

numeric terms may be rational. 8.PFA.1.B	
Determine whether a relation, represented by a set of ordered pairs, a table, or a graph of discrete points is a function. Sets are limited to no more than 10 ordered pairs. 8.PFA.2.A	**a** **Determine whether a relation, represented by a set of ordered pairs, a table, or a graph of discrete points is a function. Sets are limited to no more than 10 ordered pairs.** 8.PFA.2.A
Identify the domain and range of a function represented as a set of ordered pairs, a table, or a graph of discrete points. 8.PFA.2.B	**b** **Identify the domain and range of a function represented as a set of ordered pairs, a table, or a graph of discrete points.** 8.PFA.2.B
Determine how adding a constant (b) to the equation of a proportional relationship y = mx will translate the line on a graph. 8.PFA.3.A	**a** **Determine how adding a constant (b) to the equation of a proportional relationship y = mx will translate the line on a graph.** 8.PFA.3.A
Describe key characteristics of linear functions including slope (m), y-intercept (b), and independent and dependent variables. 8.PFA.3.B	**b** **Describe key characteristics of linear functions including slope (m), y-intercept (b), and independent and dependent variables.** 8.PFA.3.B
Graph a linear function given a table, equation, or a situation in context. 8.PFA.3.C	**c** **Graph a linear function given a table, equation, or a situation in context.** 8.PFA.3.C
Create a table of values for a linear function given a graph, equation in the form of y = mx + b, or context. 8.PFA.3.D	**d** **Create a table of values for a linear function given a graph, equation in the form of y = mx + b, or context.** 8.PFA.3.D

Write an equation of a linear function in the form y = mx + b, given a graph, table, or a situation in context. 8.PFA.3.E	**e** **Write an equation of a linear function in the form y = mx + b, given a graph, table, or a situation in context.** 8.PFA.3.E
Create a context for a linear function given a graph, table, or equation in the form y = mx + b. 8.PFA.3.F	**f** **Create a context for a linear function given a graph, table, or equation in the form y = mx + b.** 8.PFA.3.F
Represent and solve multistep linear equations in one variable with the variable on one or both sides of the equation (up to four steps) using a variety of concrete materials and pictorial representations. 8.PFA.4.A	**a** **Represent and solve multistep linear equations in one variable with the variable on one or both sides of the equation (up to four steps) using a variety of concrete materials and pictorial representations.** 8.PFA.4.A
Apply properties of real numbers and properties of equality to solve multistep linear equations in one variable (up to four steps). Coefficients and numeric terms will be rational. Equations may contain expressions that need to be expanded (using the distributive property) or require combining like terms to solve. 8.PFA.4.B	**b** **Apply properties of real numbers and properties of equality to solve multistep linear equations in one variable (up to four steps). Coefficients and numeric terms will be rational. Equations may contain expressions that need to be expanded (using the distributive property) or require combining like terms to solve.** 8.PFA.4.B
Write a multistep linear equation in one variable to represent a verbal situation, including those in context. 8.PFA.4.C	**c** **Write a multistep linear equation in one variable to represent a verbal situation, including those in context.** 8.PFA.4.C

Create a verbal situation in context given a multistep linear equation in one variable. 8.PFA.4.D	**d** **Create a verbal situation in context given a multistep linear equation in one variable.** 8.PFA.4.D
Solve problems in context that require the solution of a multistep linear equation. 8.PFA.4.E	**e** **Solve problems in context that require the solution of a multistep linear equation.** 8.PFA.4.E
Interpret algebraic solutions in context to linear equations in one variable. 8.PFA.4.F	**f** **Interpret algebraic solutions in context to linear equations in one variable.** 8.PFA.4.F
Confirm algebraic solutions to linear equations in one variable. 8.PFA.4.G	**g** **Confirm algebraic solutions to linear equations in one variable.** 8.PFA.4.G
Apply properties of real numbers and properties of inequality to solve multistep linear inequalities (up to four steps) in one variable with the variable on one or both sides of the inequality. Coefficients and numeric terms will be rational. Inequalities may contain expressions that need to be expanded (using the distributive property) or require combining like terms to solve. 8.PFA.5.A	**a** **Apply properties of real numbers and properties of inequality to solve multistep linear inequalities (up to four steps) in one variable with the variable on one or both sides of the inequality. Coefficients and numeric terms will be rational. Inequalities may contain expressions that need to be expanded (using the distributive property) or require combining like terms to solve.** 8.PFA.5.A
Represent solutions to inequalities algebraically and graphically using a number line. 8.PFA.5.B	**b** **Represent solutions to inequalities algebraically and graphically using a number line.** 8.PFA.5.B

Write multistep linear inequalities in one variable to represent a verbal situation, including those in context. 8.PFA.5.C	**c** **Write multistep linear inequalities in one variable to represent a verbal situation, including those in context.** 8.PFA.5.C
Create a verbal situation in context given a multistep linear inequality in one variable. 8.PFA.5.D	**d** **Create a verbal situation in context given a multistep linear inequality in one variable.** 8.PFA.5.D
Solve problems in context that require the solution of a multistep linear inequality in one variable. 8.PFA.5.E	**e** **Solve problems in context that require the solution of a multistep linear inequality in one variable.** 8.PFA.5.E
Identify a numerical value(s) that is part of the solution set of a given inequality. 8.PFA.5.F	**f** **Identify a numerical value(s) that is part of the solution set of a given inequality.** 8.PFA.5.F
Interpret algebraic solutions in context to linear inequalities in one variable. 8.PFA.5.G	**g** **Interpret algebraic solutions in context to linear inequalities in one variable.** 8.PFA.5.G