

Themes in the Texas CCRS - Mathematics

Standard	Organizing Component	Performance Expectation	Performance Indicator
I. Numeric Reasoning	A. Number representation	1. Compare real numbers.	a. Classify numbers as natural, whole, integers, rational, irrational, real, imaginary, &/or complex.
			b. Use and apply the relative magnitude of real numbers by using inequality symbols to compare them and locate them on a number line.
			c. Order real numbers with and without a calculator using relationships involving decimals, rationals, exponents, and radicals.
			d. Represent any rational number in scientific notation.
		2. Define and give examples of complex numbers.	a. State the standard form used to represent complex numbers and describe their real and imaginary parts.
	b. Represent in and square roots of negative numbers as complex numbers.		
	c. Understand that to solve certain problems and equations, number systems need to be extended from whole numbers to the set of all integers (positive, negative, zero), from integers to rational numbers, from rational numbers to real numbers (rational and irrational numbers), and from real to complex numbers; define and give examples of each of these types of numbers.		
			1. Perform computations with real and complex numbers.
	b. Transform numerical expressions using field properties (especially the distributive property), order of operations, and properties of exponents.		
c. Solve problems involving rational numbers, ratios, percents, and proportions in context of the situation.			
B. Number operations			

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I. Numeric Reasoning - cont.	B. Number operations - cont.	1. Perform computations with real and complex numbers - cont.	d. Calculate the sum, difference, product, and quotient of two complex numbers and express the result in standard form.
	C. Number sense and number concepts	1. Use estimation to check for errors and reasonableness of solutions.	a. Identify the most reasonable solution for a given problem from a list of possible solutions; justify the choice.
			b. Use mental estimates to detect potential errors when using a calculator.
			c. Justify the need for an exact answer or an estimate in a given problem (e.g., doing taxes vs. determining amount of paint needed for a room).
II. Algebraic Reasoning	A. Expressions and equations	1. Explain and differentiate between expressions and equations using words such as "solve," "evaluate," and "simplify."	a. Define what an expression or equation represents. b. Distinguish among and apply different uses of equations; to state a definition, to represent a conditional statement, and represent an identity.
	B. Manipulating expressions	1. Recognize and use algebraic (field) properties, concepts, procedures, and algorithms to combine, transform, and evaluate expressions (e.g., polynomials, radicals, rational expressions).	a. Use the algebraic (field) properties (e.g., commutative, associative, distributive) and order of operations to transform expressions to equivalent expressions.
			b. Use the algebraic (field) properties and order of operations to evaluate variable expressions when given the value of the variables.
			c. Explain why the algorithms and procedures used to transform algebraic expressions are valid.
	C. Solving equations, inequalities, and systems of equations	1. Recognize and use algebraic (field) properties, concepts, procedures, and algorithms to solve equations, inequalities, and systems of linear equations.	a. Solve equations and inequalities in one variable (e.g., numerical solutions, including those involving absolute value, radical, rational, exponential, and logarithmic).
			b. Solve for any variable in an equation or inequality that has two or more variables (e.g., literal equations).

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II. Algebraic Reasoning - cont.	C. Solving equations, inequalities, and systems of equations - cont.	1. Recognize and use algebraic (field) properties, concepts, procedures, and algorithms to solve equations, inequalities, and systems of linear equations. - cont.	c. Use equality and algebraic (field) properties to solve an equation by constructing a sequence of equivalent equations.
			d. Use the elimination, substitution, and/or graphing method to solve a linear system of equations with two variables.
			e. Use technology when using matrices to solve linear systems with two or three variables.
		a. Represent the solution set of an equation or inequality in various ways (e.g. set notation, interval notation, graphical representation, including shading).	
		2. Explain the difference between the solution set of an equation and the solution set of an inequality.	b. Understand that the real solution to an equation can be represented as the x-coordinate of the point of intersection of two graphs.
			c. Understand the relationship between a solution of a system of two linear equations with two variables and the graphs of the corresponding lines.
	d. Graph a function and understand the relationship between its real zeros, roots, and the x-intercepts of its graph.		
	D. Representations		1. Interpret multiple representations of equations and relationships.
		b. Understand how variables can be used to express generalizations and represent situations.	
		c. Recognize the solution(s) to an equation from a table of values.	
d. Describe numerical patterns using algebraic expressions and equations in closed or recursive forms, such as arithmetic sequences.			
2. Translate among multiple representations of equations and relationships.	a. Explain the common information presented in multiple representations of a relationship.		

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II. Algebraic Reasoning - cont.	D. Representations - cont.	2. Translate among multiple representations of equations and relationships. - cont.	b. Translate one given representation to another representation (e.g., tabular to graphic, graphic to symbolic).
			c. Use multiple representations to determine rate of change.
			d. Determine if a relationship given in graphical, tabular, or symbolic form is linear or nonlinear.
III. Geometric Reasoning	A. Figures and their properties	1. Identify and represent the features of plane and space figures.	a. Construct and use drawings, models, and coordinate representations of plane and space figures in order to solve problems by hand and using technology.
			b. Recognize and describe the plane-figure components of three-dimensional figures, such as prisms, pyramids, cylinders, and cones.
			c. Describe and use cross-sections and nets of three-dimensional figures to relate them to plane figures.
			d. Describe the conic sections as intersections of a plane with a cone.
			e. Recognize and describe orthographic (top, front, side) and isometric views of three-dimensional geometric figures.
		2. Make, test, and use conjectures about one-, two-, three-dimensional figures and their properties.	a. Develop and verify attributes of lines and parts of lines in a plane and in space:
			and parts of lines in a plane and in space: parallel, intersecting, perpendicular, and skew lines; and angle relationships associated with transversals on parallel lines.
			b. Develop and verify angle relationships: vertical, complementary, supplementary, angles on parallel lines, angle-side relations in a triangle, interior/exterior angles on polygons, and angles on circles.

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III. Geometric Reasoning - cont.	A. Figures and their properties - cont.	2. Make, test, and use conjectures about one-, two-, three-dimensional figures and their properties. - cont.	c. Develop, verify, and extend properties of circles, including properties of angles, arcs, chords, tangents, secants, and spheres.
			d. Develop and verify properties of triangles and quadrilaterals (e.g., triangle congruence conditions, properties of a parallelogram).
			e. Develop and verify properties of parts of prisms, cylinders, pyramids, and cones.
			f. Apply properties of geometric figures to solve problems.
			a. Apply the Pythagorean Theorem and its converse to solve real-life situations in two and three dimensions.
			b. Apply Pythagorean triples and special right triangle relationships to solve problems.
	B. Transformations and symmetry	1. Identify and apply transformations to figures.	c. Solve right triangle situations using sine, cosine, and tangent.
			a. Identify whether a transformation is a reflection, rotation, translation, or dilation.
			b. Find the image or pre-image of a given plane figure under a congruence transformation (e.g., translation, rotation) or composition of these transformations in coordinate and noncoordinate plane settings.
			c. Find the image or pre-image of a given plane figure under dilation or composition of dilations in coordinate and non-coordinate plane settings.
			d. Use transformations and compositions of transformations to investigate and justify geometric properties of a figure (e.g., the sum of the three angles inside any triangle is 180 degrees).
			e. Use transformations and compositions of transformations to investigate and justify geometric properties of a figure (e.g., the sum of the three angles inside any triangle is 180 degrees).
2. Identify the symmetries of a plane figure.	a. Identify and distinguish between reflectional and rotational symmetry in an object.		
	b. Identify congruent corresponding parts in a figure with reflectional or rotational symmetry.		

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III. Geometric Reasoning - cont.	B. Transformations and symmetry - cont.	2. Identify the symmetries of a plane figure. - cont.	c. Identify lines of symmetry in plane figures to show reflection.	
		3. Use congruence transformations and	a. Use congruence transformations to justify congruence among triangles and to identify congruent corresponding parts.	
			b. Use dilations and scale factors to investigate similar figures and determine missing image or pre-image dimensions.	
			c. Identify symmetries in design situations and describe transformations used to create the symmetry and design (e.g., tiling problems).	
	C. Connections between geometry and other mathematical content strands	1. Make connections between geometry and algebra.	a. Describe lines in the coordinate plane using slope-intercept and point-slope form.	b. Use slopes to describe the steepness and direction of lines in the coordinate plane and to determine if lines are parallel, perpendicular, or neither.
				c. Relate geometric and algebraic representations of lines, segments, simple curves, and conic sections [e.g., describe algebraically a circle centered at (h, k) with radius (r)].
			d. Investigate and justify properties of triangles and quadrilaterals using coordinate geometry.	e. Relate the number of solutions to a system of equations of lines to the number of intersections of two or more graphs.
			2. Make connections between geometry, statistics, and probability.	a. Compute probabilities using lengths of segments or
		3. Make connections between geometry and measurement.	a. Determine perimeter and area of two-dimensional figures and surface area and volume of three-dimensional figures using measurements and derived formulas.	

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III. Geometric Reasoning - cont.	C. Connections between geometry and other mathematical content strands - cont.	3. Make connections between geometry and measurement. - cont.	b. Find the measures of the lengths and areas of similar figures and of the lengths, surface areas, and volumes of similar solids.
			c. Find arc length and sector area for a given central angle on a circle.
	D. Logic and reasoning in geometry	1. Make and validate geometric conjectures.	a. Use drawings, manipulatives (e.g., paper folding, transformations) and constructions (e.g., compass/straight-edge, computer graphing utility) to investigate patterns and make conjectures about geometric properties of figures.
			b. Use counterexamples to verify that a geometric conjecture is false.
			c. Give a logical argument in a variety of formats to verify that a geometric is true.
			d. Use a conditional statement to describe a property of geometric figure. State and investigate the validity of the statement's converse, inverse, and contrapositive.
			e. Make the connection between a biconditional statement and a true conditional statement with a true converse.
	2. Understand that Euclidean geometry is an axiomatic system.	a. Distinguish among theorems, properties, definitions, and postulates and use them to verify conjectures in Euclidean geometry.	
		b. Understand that non-Euclidean geometries exist.	
IV. Measurement Reasoning	A. Measurement involving physical and natural attributes	1. Select or use the appropriate type of unit for the attribute being measured.	a. Determine appropriate units of measurement needed for the object being measured in a given situation (e.g., unit analysis, degree, or radian measure of an angle.)
			b. Select and accurately use an appropriate tool to make measurements.

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IV. Measurement Reasoning - cont.	A. Measurement involving physical and natural attributes - cont.	1. Select or use the appropriate type of unit for the attribute being measured. - cont.	c. Recognize and use significant digits to determine the accuracy of a measurement in problem situations. d. Use the appropriate level of precision when providing solutions to measurement problems. e. Know when to estimate and approximate measurements for given problem situations.
	B. Systems of measurement	1. Convert from one measurement system to another.	a. Convert between basic units of measurement from one system to another system (e.g., inches to centimeters, kilometers to miles, pounds to kilograms).
		2. Convert within a single measurement system.	a. Convert between basic units of measurement within a system (e.g., inches to feet, square inches to square feet, grams to milligrams).
	C. Measurement involving geometry and algebra	1. Find the perimeter and area of two-dimensional figures.	a. Describe the difference between perimeter the units of measurement used in their calculation.
			b. Solve problems involving perimeter and area of two-dimensional simple and composite figures with some unknown dimensions (e.g., triangles, quadrilaterals, circles).
			c. Solve problems involving the distance between two points in the coordinate plane and make algebraic and geometric connections.
		2. Determine the surface area and volume of three-dimensional figures.	a. Describe the difference between surface area and volume of three-dimensional figures and the relationship in the units of measurement used in their calculation.
	b. Solve problems involving surface area and volume of three-dimensional simple and composite figures with some unknown dimensions, including prisms, pyramids, cylinders, cones, and spheres.		

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IV. Measurement Reasoning - cont.	C. Measurement involving geometry and algebra - cont.	3. Determine indirect measurements of figures using scale drawings, similar figures, the Pythagorean Theorem, and basic trigonometry.	<p>a. Determine how changes in dimension affect the perimeter, area, and volume of common geometric figures and solids.</p> <p>b. Solve problems using proportional relationships in similar two-dimensional and three-dimensional figures to determine unknown measurements.</p> <p>c. Determine unknown sides and angles in a right triangle using the Pythagorean Theorem and basic trigonometry.</p>
	D. Measurement involving statistics and probability	1. Compute and use measures of center and spread to describe data.	<p>a. Select, compute, and justify measurements of center (e.g., mean, median, mode) based on the data set and other influential information.</p> <p>b. Select, compute, and justify measurements of variation (e.g., range, IQR, percentiles, variance, standard deviation) based on the data set and other influential information.</p> <p>c. Calculate weighted averages, indices, and ratings.</p>
		2. Apply probabilistic measures to practical situations to make an informed decision.	a. Justify decisions made from probability measures from a set of data.
			b. Interpret given probability measures in a problem.
			c. Use and interpret a normal distribution as a mathematical model of measurement for summarizing some sets of data.
	V. Probabilistic Reasoning	A. Counting principles	1. Determine the nature and the number of elements in a finite sample space.

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V. Probabilistic Reasoning - cont.	B. Computation and interpretation of probabilities	1. Compute and interpret the probability of an event and its complement.	a. Conduct an experiment or simulation to compute the empirical probability of an event and its complement.
			b. Compute and interpret the theoretical probability of a simple event and its complement.
			c. Compare the empirical and theoretical probabilities of an event (e.g., experimental probabilities converge to theoretical probability as the number of trials increases).
		2. Compute and interpret the probability of conditional and compound events.	a. Distinguish between independent and dependent events.
			b. Explain the meaning of conditional probability and know when to use it.
			c. Compute conditional probability.
			d. Compute the probability of compound events using tree diagrams, tables, and other methods.
			e. Compute the probability for dependent or independent compound events.
VI. Statistical Reasoning	A. Data collection	1. Plan a study.	a. Determine question(s) that can be answered with data.
			b. Explain the difference between observational and experimental studies.
			c. Design and employ a plan of study to collect appropriate data.
			d. Use a variety of sampling methods (e.g., census, systematic sampling, random vs. non-random sampling).
			e. Identify sampling techniques used in our world (e.g., political polls, medical studies) and determine possible sources of bias.
			f. Compare and contrast data variability using different sampling methods.

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VI. Statistical Reasoning - cont.	B. Describe data	1. Determine types of data.	a. Recognize and describe the differences between quantitative and qualitative data. b. Recognize and describe univariate and bivariate data.	
		2. Select and apply appropriate visual representations of data.	a. Organize and construct graphical displays of data (e.g., line plots, bar graphs, histograms, box plots, scatter plots) to describe the distribution of data. b. Read and interpret graphical displays of data.	
		3. Compute and describe summary statistics of data.	a. Calculate, describe, and use the appropriate measure of center (e.g., mean, median, mode) and spread (e.g., range, IQR, percentiles, variance, standard deviation). b. Describe the effect of outliers on summary statistics.	
		4. Describe patterns and departure from patterns in a set of data.	a. Describe any natural variability evident in the results within the context of the situation. b. Describe any influences that may have induced variability within the context of the situation.	
		C. Read, analyze, interpret, and draw conclusions from data	1. Make predictions and draw inferences using summary statistics.	a. Make a prediction about long-run behavior (e.g., coin toss). b. Draw conclusions from analyzing a set of data.
			2. Analyze data sets using graphs and summary statistics.	a. Analyze and compare distributions by describing similarities and differences of centers and spreads within and between data sets. b. Analyze and describe similarities and differences by comparing graphical distributions (e.g., parallel box plots, back-to-back stem-leaf plots) within and between data sets.
			3. Analyze relationships between paired data using spreadsheets, graphing calculators, or statistical software.	a. Describe relationship and trend of paired data observed from scatter plots in the context of the situation.

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VI. Statistical Reasoning - cont.	C. Read, analyze, interpret, and draw conclusions from data - cont.	3. Analyze relationships between paired data using spreadsheets, graphing calculators, or statistical software. - cont.	b. Choose an appropriate linear or non-linear regression model to fit paired data based on graphical analysis.
		c. Make a prediction using the appropriate regression model and describe any limitations to the calculated prediction.	
		4. Recognize reliability of statistical results.	a. Evaluate media reports by analyzing the study design, data source, graphical representation of data, and analyzed data results reported (or not reported).
			b. Describe generalizations and limitations of results from observational studies, experiments, and surveys.
			c. Identify and explain misleading uses of data. d. Describe the reliability of statistical results from a set of data.
Reasoning			
Connections			
Problem Solving			